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**Electricity in Mining.** ONE of the greatest fields that electric power has of late been called upon to enter is that of mining. The use of the electric light in mines is not new, and possibly its success has helped create the demand that has sprung up for power appliances. Be that as it may, there can be no doubt as to the reality and extent of the demand, and vast as are the fields already opened up for the electric motor, it may seriously be questioned whether the opportunities in mining, the latest sphere of its occupation, do not surpass all others. We believe that 1890 is destined to be the conspicuous year as the starting point of electric mining on the grand scale, as 1889 was for electric railroading, and we have, therefore, devoted the larger portion of our present issue, the first of the year, to the description of several new forms of apparatus intended for the work, accompanied by a variety of data and discussion of interesting topics connected with the subject. One cheering feature in connection with the new departure we have thus distinguished is the hearty welcome accorded the new power by the mining journals, mining experts, and the mining world in general. There has been at once an absence of prejudice and a keen appreciation of the advantages that electricity can give, and it now depends upon electrical inventors and electrical engineers to rise to the occasion and reap the rewards that await ready ingenuity and honest work. They may form some idea of the immensity of the field from the statement of the *Engineering and Mining Journal* that the value of American mining products in 1888 exceeded $590,000,000; and that during the past year the industry has been no less prosperous. It is the province of electricity not only to aid in the economical and safe production of this great wealth, but to bring up to the point of remunerative productiveness hundreds of mines that are worthless under other conditions.

**Double Carbon Arc Lamps.** WE give in full in this issue the text of the decision of Judge Gresham awarding to Mr. C. F. Brush, who is once again shown to be a pioneer, priority in the invention of double carbon arc lamps. There are a great many of such lamps in use, and the award is an important one. One effect will probably be to stimulate invention in regard to lamps having a longer burning capacity before the need of recarboning arises.

**Death of Pacinotti.** ONE by one the pioneers in modern electricity are dropping off, and to the death of Planté in the early part of this year must now be added that of Pacinotti. In several respects the careers of these men were alike. Both accomplished a decided advance in the application of scientific principles, but the work of both was destined to lie slumbering until later advances again recalled it to the memory of electricians. The credit due to Pacinotti is none the less great because his work was overshadowed by that of Gramme, and the Pacinotti ring will always remain as the undoubted prototype of the modern ring armature that has been of such vital importance in the evolution of the dynamo.

**The Shrewd New South.** THE Baltimore *Manufacturers' Record*, which, by its intelligent and persistent work, has done so much to build up the industrial interests of the New South, has made a summary of the enterprises organized in the South during the last four years. From these authentic figures it appears that since Jan. 1, 1886, there have been 101 gas works companies started in the South and 475 electric light companies. This shows a remarkable preference for electricity, yet one that might be expected where newer communities have the opportunity of choice. The result is that many Southern towns and cities enjoy an illumination of streets and homes not to be matched in the East. The statistics of our progressive contemporary do not bring out the fact, but it is not the less true that the South has been as kindly disposed toward electric railways as to electric lighting, and that it has helped give the new industry its rapid development.

**Common Sense in Cincinnati.** To those papers in this city which have lost their heads and have been printing columns of wild nonsense and absurdities about electricity, we would commend the common-sense views of the Cincinnati *Commercial Gazette*, which advises its readers not to be alarmed or panic stricken by the reports from New York. It adds: "A great many people have been killed in Cincinnati by the explosion of steam boilers, but it is not proposed to abandon the use of steam altogether. There have been leakages of gas which have caused the blowing-up of houses and destruction of life, but it is not proposed that we shall get along without illuminating gas. Deaths have occurred many times in our streets from runaway horses. It has not been esteemed essential to abolish horses. What we want is the light of science and the application of experience, not the incitement of public alarms and the excitements that lead to violence."

**The February Convention.** THE arrangements now being actively made for the convention of the National Electric Light Association at Kansas City in February promise one of the best meetings ever held. The programme of papers and topics is remarkably interesting, and recent events are likely to give unusual value and importance to the discussions, especially as there are indications that the attendance will be far beyond the average from all parts of the country. We publish various items this week in regard to the preliminary work, and take this opportunity to urge upon all our electric light readers the advisability of being present. Their companies as members of the association can derive great benefit from its work, if they see to it that its affairs are properly conducted with an eye to the welfare of the industry. There never was a time when the association could be more useful, and it should receive the heartiest support.

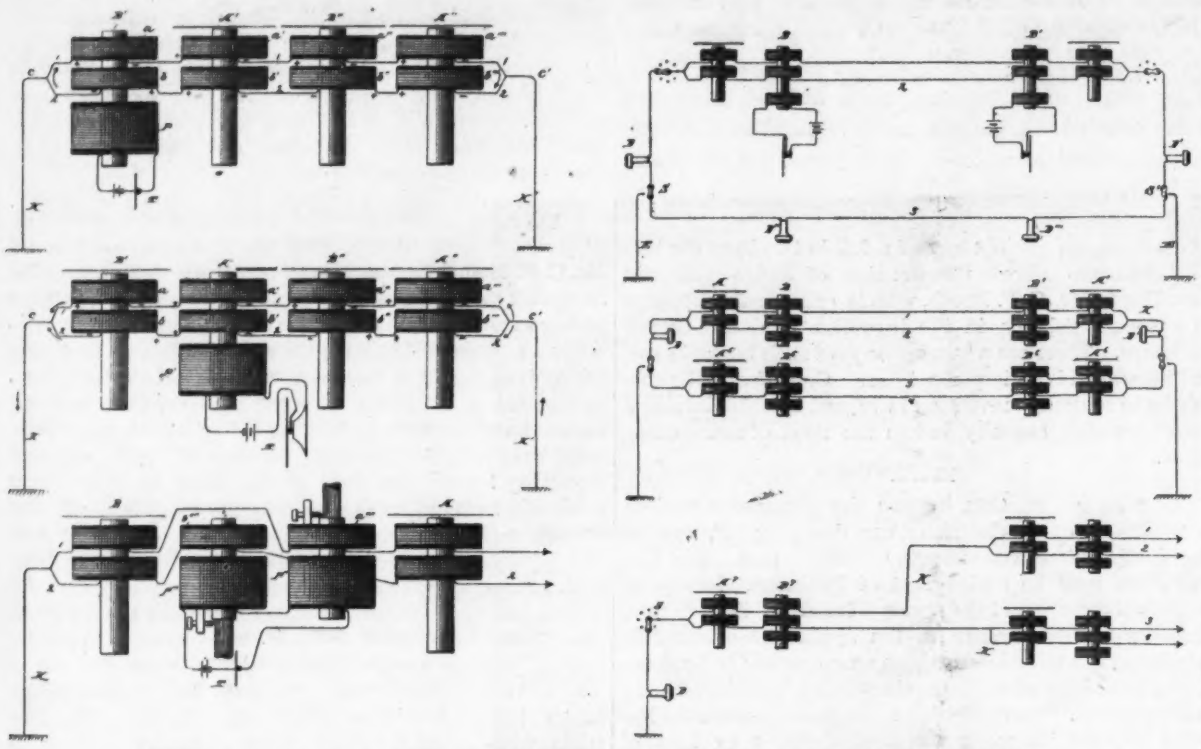
**Attacking Electric Roads.** THRICE last week the New York *World* published long articles attacking the electric roads of the West End Railway Company in Boston. These articles are veritable curiosities. Nothing more extraordinary has seen the light of day recently, although the papers have been trying to excel each other in absurdity of statement as to what electricity is and can do. To give an idea of the "utter rot" of which the article is composed, we may quote the following: "Suddenly, by reason of a slight catch of the trolley wheel on a point of the overhead wire, the latter falls on the car. * * * The latter contains sixty or sixty-five passengers. * * * A circuit is formed, and we all know what a shock of this kind means. You may picture the stiffened corpses that are removed through doors and windows." The whole article is full of such imbecility, livened up with all manner of inuendo and inaccuracy; and where something cannot be invented against electricity, abuse is lavished on the West End Company as a corporation. But one explanation is possible for such a wretched, miserable piece of "journalism." Anything more desperate and disgraceful as a fake it would be impossible to find.

**The Safety of Electricity.** THE New York *Commercial Advertiser*, with the distinguished help of Mr. C. F. Heinrichs, the worthy gentleman who once tried to exploit an arc-lighting system in this city, but is now posing as an advocate of strictly low tension currents, publishes an article to illustrate the remarkable fact that electricity is as deadly in Europe as it is here. The list it prints, as supplied by Heinrichs, who has ransacked the records, shows that since 1880, or in a period of about ten years, there have been the alarming number of 13 deaths from electricity! One per year, about, for all Europe! Just think of it! Why, there were only 135 persons killed and 300 injured in the cartridge factory explosion at Antwerp last September—a mere bagatelle in the way of destruction. There were 13 women killed by the collapse of a carpet factory in Glasgow last November, but the incident was barely mentioned. There were several thousand deaths by fire in Suchow, China, last June, but the notice was of the briefest kind. In July the Yellow River broke through its insulation, and flooded ten districts with twelve feet of water, causing a loss of life exceeding calculation, but even that was curtly dismissed in a short item. It seems to us about time that the daily papers put their ideas and records of accidents in the proper perspective. The *Commercial Advertiser* is old enough to have learned the art of discrimination in these matters. Let it go through its own files and sum up its own reports of the deaths and fires it has noted from gas or oil or candles since it began publication, and it will soon find that electricity can compare favorably with any of them.

**Electricity and Insurance.** NOTWITHSTANDING that rules for the safe running of wires and installation of electric light plants are well known, or at least can be gotten out with very little trouble, the fact remains that the manner in which this class of work is still done is open in many cases to criticism. This fact has been called to our attention more than once by electricians from abroad, the most recent of whom, Mr. Addenbrooke, in a paper read before the London Institution of Electrical Engineers, speaks on this point at length; but these criticisms have often little effect upon those in charge of such installations, and it is only when their pockets become directly affected by the condition of affairs involved in such practices that they begin to realize that some change is desirable. This does not happen, as a rule, until the insurance inspector on his rounds sees the faulty construction both of the station and of the equipments, and fixes the rate of insurance accordingly. Then there is heard a great wail and not unfrequently complaint of unfair treatment. It is safe to say, however, that the insurance companies would not place any obstacles in their own path to secure business, and their action is prompted as a measure of self-defense. They are indeed in many cases justified, especially when they get a report such as that which has been recently made by Mr. A. E. Braddell to the secretary of the Insurance Association of the Middle Department, at Philadelphia. Mr Braddell, who is thoroughly equipped with a theoretical and practical knowledge of electric lighting, inspected 57 electric light stations and isolated plants in Pennsylvania, and as his report shows, the work as a whole, is poor, particularly in the running of wires. The defects which he points out as existing in the installations are probably but a fair sample of what would be found in almost any other State upon as rigid an examination. It is natural to suppose that the insured parties will at first object to the enforcing of what might appear too stringent rules; but the experience gained in New England is, that once the change has been made the insured parties themselves are pleased even more than the insurance companies, and, leading as it does to lower insurance rates, it finally turns out to be a direct gain to the insured. Mr. Braddell's experience also demonstrates that a better class of attendance should be insisted upon for electric light stations than seems to be the case at present; and it is to be hoped that some measures may be adopted to secure for other localities the benefits which undoubtedly have accrued from the establishment of the license system undertaken by the New England Electric Exchange, whose work has served to lift the standard of efficiency far above that which existed in the New England stations, especially in the district of Boston. The Middle Department is to be congratulated on securing the services of so competent and conscientious an inspector as Mr. Braddell.

### The Rosebrugh Duplex Telephone System.

It is evident that when a metallic telegraph or telephone circuit is grounded at both ends, and electrical impulses are generated in either branch of the metallic circuit, the currents so generated will divide at the points where the metallic circuit is grounded, and a large percentage of the



FIGS. 1, 2, 3, 4, 5 AND 6.—ROSEBRUGH'S DUPLEX TELEPHONE SYSTEM.

currents, instead of continuing in the circuit, will escape to earth through the ground wires.

In seeking to apply this phenomenon to the problem of duplex telephony, Dr. Abner M. Rosebrugh, together with his son, Mr. P. R. Rosebrugh, of Toronto, Can., discovered that when electrical impulses of equal strength are generated in both branches of the metallic circuit simultaneously and in opposite directions, the currents so generated may be made to continue in the metallic circuit without affecting, or being affected by, the two ground wires. They also discovered, after much experimenting, that this can be accomplished in several ways—as, for instance, first, by using a transmitter with a doubly-wound secondary coil, one coil for each branch of the metallic circuit; secondly, by using a transmitter with two induction coils, the primaries being connected either in series or in multiple arc.

By the application of these principles it is made possible for two telephone subscribers, or a telephone subscriber and a telephone operator at each end of a metallic circuit, to communicate with each other simultaneously.

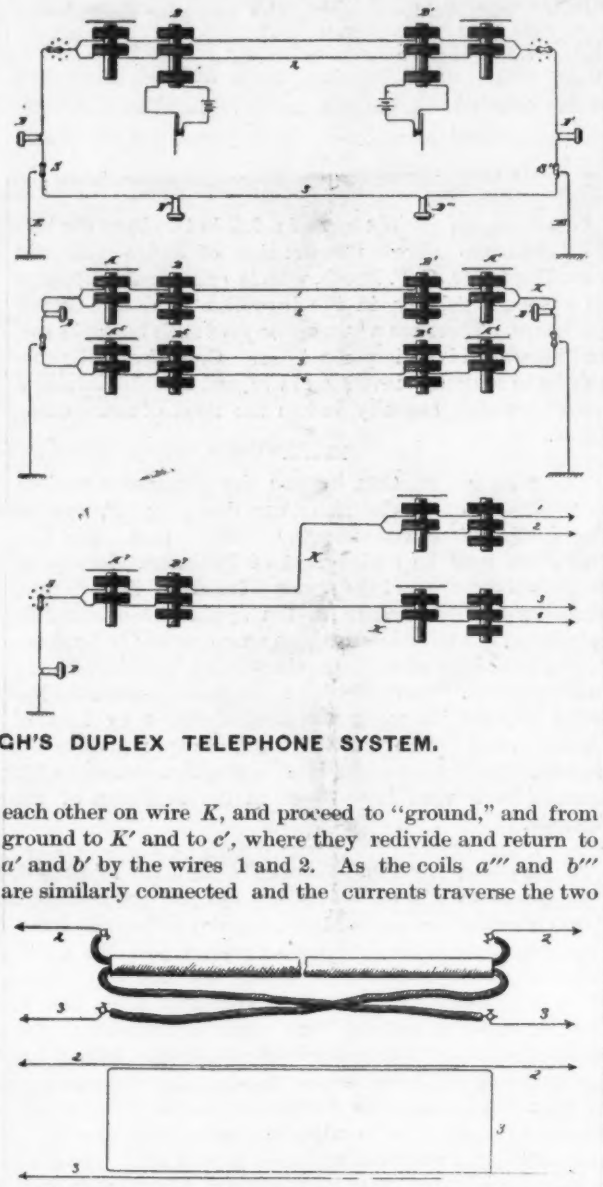
This system of duplex telephony, which has recently been patented in this country, is illustrated in the accompanying diagrams.

In Figs. 1, 2 and 3, $B'$ and $A'$ are duplex or differentially-wound telephonic transmitters, $B''$ and $A''$ are correspondingly wound receivers. In Fig. 1, $B'$ is transmitting and $B''$ is receiving, and in Fig. 2, $A'$ is transmitting and $A''$ receiving. No. 1 and No. 2 are the two wires of the metallic circuit, and $K$ and $K'$ are ground wires.

The transmitters $B'$ and $A'$ are provided with a primary wire and with two secondary coils on a soft iron core, while the receivers $B''$ and $A''$ have two coils on a soft iron core magnetized by a permanent magnet. The coils $a$, $a'$, $a''$ and $a'''$ are in circuit with No. 1 wire, while the coils $b$, $b'$, $b''$ and $b'''$ are in circuit with No. 2 wire. The coils $p$ and $p'$ are primary coils, and are in circuit with a local battery and a microphone $T$. Following No. 1 wire from the point $c$ in the direction of the arrows from left to right, it will be seen that the wire enters the coil $a$ by the outside terminal, marked +, and makes its exit by the inside terminal, marked —. The connection is the same with $a'$, $a''$ and $a'''$, and on tracing the connection of the wire No. 2 from the point $c'$ to $c$ it will be seen that the coils $b''$ and $b$ are connected from the outside to the inside (+ to —), while the coils $b'''$ and $b'$, on the contrary, are connected from the inside to the outside (— to +).

Referring to Fig. 1, it will be seen that upon operating the microphone $T$ the soft iron core will generate secondary currents in the coils $a$ and $b$, presumably of equal strength, and as the outside or + wire of coil $a$ is connected with the inside or — wire of coil $b$ and on corresponding ends, the current from $a$ will reinforce the current from $b$, and a current will be generated in the metallic circuit in the direction indicated by the arrows, the current in No. 1 wire moving in one direction and the current in No. 2 wire moving in the opposite direction. It will also be seen that from the peculiarity of the connection of the coils at $A'$ and $A''$ the currents in coil $a'$ will neutralize the currents in $b'$, and the currents in coil $a'''$ will neutralize the currents in $b''$, whereas, on the contrary, the currents in coils $a''$ and $b''$ will reinforce each other; hence the receiver $B''$ will respond to the transmitter $B'$, while the receiver $A''$ will be neutral thereto.

Again, refering to Fig. 2, it will be seen that by operating the microphone $T$, independent secondary currents will be generated in coils $a'$ and $b'$, and will move toward the point $c$ on wires 1 and 2, and in the same direction as indicated by the arrows. At the point $c$ these currents meet, and were it not for the ground wire $K$ they would neutralize each other; whereas, on the contrary, they reinforce each other on wire $K$, and proceed to "ground," and from ground to $K'$ and to $c'$, where they redivide and return to $a'$ and $b'$ by the wires 1 and 2. As the coils $a'''$ and $b'''$ are similarly connected and the currents traverse the two



FIGS. 7 AND 8.—ROSEBRUGH'S DUPLEX TELEPHONE SYSTEM.

wires in the same direction, receiver $A''$ will respond, and, as the coils $a'$ and $b'$ are similarly connected, $A'$, were it a receiver, would also respond. On the contrary, as the coils of $B'$ and $B''$ are dissimilarly connected, these receivers will remain neutral; hence, when $B'$ transmits to $B''$, $A'$ and $A''$ are neutral, and when $A'$ transmits to $A''$, $B'$ and $B''$ are neutral. In the former case the currents traverse the two wires of the metallic circuit in opposite directions, and in the latter case the currents move on the two wires in the same direction, the circuit being completed by means of the ground or by a return wire.

The same object may be attained in other ways, such as are illustrated in Fig. 3. In Fig. 4, 1 and 2 are the two wires of a metallic circuit. By means of the switches, $S$ and $S'$, the two subscribers, $D$ and $D'$, may either use a ground wire or a metallic circuit return wire at pleasure.

In Fig. 5 the arrangement is the same as in Fig. 4, but the two wires, 3 and 4, are used as a common return wire.

In Fig. 6 the branch line, $K$ $K$, is also represented as being duplexed, $A^7$ $B^7$ representing duplex telephonic apparatus in the branch lines. In this latter arrangement it will be seen that with two metallic circuits three operators and a subscriber at each end of a line may communicate with each other simultaneously without interference. In this arrangement two or more wires are used as a single conductor. This increases the area or cross-section of the conductor and necessarily facilitates long-distance telephony.

When telephone wires are conducted parallel to each other, particularly on long lines, they affect each other by induction. Various ways may be used to overcome these effects when one or both of the wires form part of a metallic circuit—as, for instance, a section of one wire may be brought within close proximity with the other, but the direction reversed. To accomplish this Messrs. Rosebrugh use a cable with two insulated wires, the terminals of which are connected, the one with wire No. 2 direct and the other with wire No. 3 reversed, as shown at Fig. 7, or the wires may be connected, as indicated in Fig. 8, respectively.

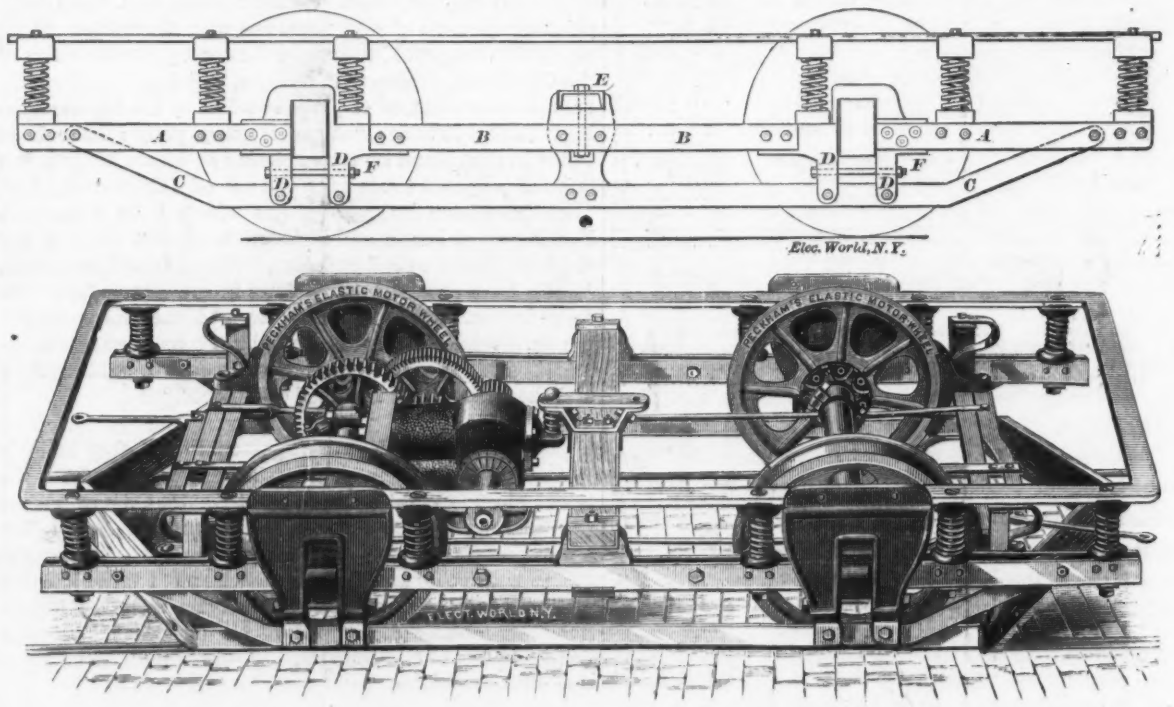
### Overhead Telephone Wires as Lightning Protectors.

It would seem, according to a recently published correspondence between Dr. Stephan and the Madgeburg Insurance Company, that an overhead telephone system forms a very effectual protection against lightning. From 1883 to 1888 there has been only one case of damage by lightning in the centre of Hamburg, where the wires are dense, while there have been numerous instances in the suburbs. A similar immunity has been experienced in Berlin and other towns where there are large numbers of overhead telephone wires. Dr. Stephan points out in this correspondence that the German telephone systems are constructed with the greatest care and are well provided with lightning arresters.

### The New Peckham Electric Car Truck.

The advent of the electric street car has necessarily brought about considerable change in the nature of the truck upon which the car body is mounted. Among the recent leading improvements in this department is the truck shown in the accompanying engraving, Fig. 1. This truck was designed by Mr. E. Peckham, of the Peckham Street Car Wheel and Axle Company, to effect a practical lengthening of the wheel-base without actually increasing the distance between the axles. In order to effect this the truck has been designed so as to effect an extension by means of a support in the shape of a cantilever truss.

This is shown at $AA$ in the diagram Fig. 2. which represents the truck in side elevation. Malleable iron yokes $DD$ fit over the journal boxes and are made in one piece so as to hold the boxes in position. To these yokes is secured the cantilever truss $CC$, which supports the extensions $AA$. The central bars $BB$ unite the yokes over the journal boxes, and are so constructed that they can readily be removed when it is desired to remove the armature from the motor.




FIGS. 1 AND 2.—THE NEW PECKHAM ELECTRIC CAR TRUCK.

Supported on a crosspiece is a hanger $E$, which is provided with a spring and supports one end of the motor, as shown in Fig. 1. In order to prevent the rising of the yokes and journal boxes from the journals, the bolts $F$ $F$ are provided, which allow of a limited play, but effectually tie the truss to the axles,

The truck has a wheel base of 6 feet, and its entire length is 12 feet. The car-body rests on twelve springs, and the result of the arrangement is a steady motion of the car.

## The Electric Mining Apparatus of the Sprague Company.

One of the most promising fields opened up for the use of the electric motor has been that of mining. The main reason for the hearty welcome given by miners to electric apparatus probably is, that it admits of practical and economical long distance transmission of power in a manner and to a degree not dreamed of a few years ago, so that mines which have yielded small returns or have even been abandoned, though within a few miles of inexhaustible water powers, have immediately been brought by the aid of electricity within the category of permanent and profitable enterprises. Another pleasing and noteworthy feature of electric plant has been its handiness, and the ease with which the motor may be conjoined with almost any other kind of machinery in almost any kind of position, so that crude, barbarous and wasteful processes have no longer been a cruel necessity, but are substituted by those that in reality deserve the name of scientific. A third great recommendation for electric motors in mining has been their simplicity of mechanism and absence of complex detail. These advantages were frankly admitted recently by a well-known mining authority in this country, the *Colliery Engineer*, which said: "It has been demonstrated in several instances that it is one of the best mediums for the transmission of power, haulage, pumping, coal-cutting, rock-drilling, and in fact for every kind of work that requires the carrying of power underground. On the surface it is especially adapted to work being done by machinery at any considerable distance from the main power plant. The locations of many ventilating fans are such as to make electricity by far the cheapest and most convenient power. The running of pumps can be done much cheaper and more conveniently by electricity than by steam. Every colliery official recognizes the disadvantages of steam-pipe running to pumps in mines. They not only make the atmosphere unfit for traveling through, but they cause dry rot in timbers and disintegration of the roof. These same results, besides loss of power by condensation, can be charged against steam-pipe carried into a mine for any mechanical purpose."

Encouraged by the evident demand for electric mining apparatus, and pushing forward with its wonted enterprise, the Sprague Electric Railway and Motor Company has now prepared a number of special sets of electric mining tools and machines, studying out in each case the best means of adjusting the motor to the appliance, and seeking to give the ingenuity of the inventor its best expression and highest utility. We have much pleasure in illustrating herewith several of these pieces of apparatus, with a few words of running comment and explanation.

It has not been so difficult a problem, it is said, to adapt electric motor service in the tramways of coal mines as in those of metal mining, where great compactness, strength and traction for the space that can be occupied are required. To get the needed energy into the required limited space has been the most difficult problem for solution. In the Sprague locomotive for metal mines these necessary conditions have been secured. The outside dimensions of a 15 h. p. locomotive for an 18-inch gauge are 30 inches in width, 30 inches in height, 62 inches in length. We illustrate the locomotive in Fig. 1, which shows a machine of a total weight of from 3,000 to 4,000 pounds. Such machines can be used in a space where even a mule could not be worked.

The ability to easily and quickly change the position of and re-locate the motor at any point where power is wanted, is of itself a feature of importance in mining operations. For instance, a motor might be delivering 20 h. p. at a heading 500 feet from the shaft in one direction and be wanted an equal distance opposite. The permanent adjustment of the motor can be made upon a truck, upon which it could be easily moved to any desired position. When called upon for service elsewhere, the conductor can be reeled up, and in an hour the motor would be in its new position ready for work.

An illustration of the advantages of such a moving source of energy in mining operations is shown at the Himes Colliery, Osceola Mills, Pa., where a 10 h. p. Sprague electric motor, mounted on a truck, as shown in the illustration, Fig. 2, operates a Stine-Smith coal cutter 20 or 30 feet away; and from the fact of its mobility, one motor, thus mounted, does the work of three stationary engines of the same power. Each coal cutter thus operated cuts ten tons of coal per hour, from a soft bituminous to the hardest anthracite, without gas, smoke or dust, doing the work of at least ten men, with less danger to men and machine, and far greater economy.

An expert of the Sprague Company recently witnessed the operation of one of these coal cutters in a Pennsylvania colliery, where the cutter struck a "horse" in the vein, which was composed of slate, sand and sulphur, making a very hard rock conglomerate, and cut its way through the same, which was two feet in thickness and three feet in width, in the space of ten minutes. It would have required the work of two miners for at least an hour with their picks to have freed the vein from the obstacle. Our next illustrations show some other apparatus of the locomotive class, and of very novel and ingenious nature, which have been specially devised for the excavation and treating of gold-bearing sand and gravel. The plant, Figs. 3, 4 and 5, comprises the amalgamator of Mr. E. S. Bennett, of Denver, Col., and the No. 2 excavator of the Osgood Dredge Company, of Albany, N. Y., with the Sprague electric motors as motive power of both machines. The amalgamator has a capacity of 60 cubic yards of gravel per hour, and uses but 12 miner's inches of water per yard. It stands on the same track as, and is coupled to, the excavator, and is driven by a 20 h. p. standard motor placed on the excavator car connected by suitable gearing and chain belts.

The excavator is the Osgood No. 2, standard capacity 125 cubic yards per hour, with the addition of a conveyor to carry the gravel from dipper of excavator to hopper of amalgamator, and with powerful propelling gear to move both machines at once. The dipper is provided with grates to prevent taking up any boulders too large to pass through the amalgamator. The intention is that later one excavator will supply two amalgamators. The excavator carries three motors; one 25 h. p. standard motor, which digs the gravel, swings the boom, and propels the two machines; one 15 h. p. street car motor, which crowds the dipper into the bank and pulls it in when swung over the hopper; and one 20 h. p. standard motor, which operates the amalgamator and conveyor. There is also a motor, not shown, which drives a pump for supplying the amalgamator with water and washing away the tailings.

There are also electric lights for operating at night. The current is generated by a 100 h. p. dynamo, driven by water power, situated one to twenty miles from the above described mining plant.

This plant is operated by the Bennett Amalgamator Company of Denver, near that city, and affords an unusually good illustration of the capabilities of the Sprague system, as the excavator requires motors working intermittently, and with loads and speeds varying independently of each other, and between great extremes; while the amalgamator requires a steady speed, with varying load. Both machines are driven by one dynamo.

The three companies represented in this plant are perfecting plans for larger plants of the same type, and also for handling gold bearing material under water. Of course the electric dredging and excavating apparatus can be applied to, practically, any class of land or water work.

Reference has just been made to the Bennett amalgamator. In view of the fact that electricity gives it so much value, a word more in passing on that topic will not be out of place. It is claimed to be a highly scientific and thoroughly proven system, or combination, for the economical extraction on a large scale not only of the coarser gold usually saved by the ordinary methods of hydraulic mining, but also of the infinitely fine particles, which, though separately invisible, constitute a very large percentage and not unfrequently the bulk of value in auriferous alluvial deposits. These plants, heretofore operated entirely by steam power, have found their field limited to such points as were near to fuel supplies, and their usefulness dwarfed by the fact that their capacity could not be increased beyond a comparatively small limit, owing to the necessity of their being constantly moved over the ground, and the large boilers, engines, feed-water tanks, coal bins, heaters, and the various other appurtenances of complete steam motors, rendering the larger plants too unwieldy, to say nothing of the difficulty and expense of hauling fuel to and landing it over the necessarily broken ground on to the plant; while the utilization of water power, if at hand, by any of the usual methods of transmission was impracticable or impossible. The advent of electrical transmission, however, has so marvelously enlarged the field of usefulness for these plants, that it is now but a question of a short time when they will entirely revolutionize the placer mining industry throughout the world.

This will not seem an extravagant statement when it is considered that a single "Bennett amalgamator," known, for instance, as a "No. 3 River Plant," with its power house and 300 h. p. dynamo situated perhaps several miles distant from the scene of operation, either at a railroad station or some point where water power can be utilized, easily treats 6,000 cubic yards of the river bed gravel per day at a total working cost of from 1 to 1½ cents per cubic yard, extracting therefrom every grade of gold, from nuggets down to and including the finest gold. Another feature is that by the aid of electricity these plants are now equally well adapted to work high up on the hillside, or down in the deep, narrow gulches. They require comparatively but little water, which need not be above, but may be taken from below the level of the ground being worked. Though desirable, a dump for tailings is not essential. These plants are fully prepared and competent to handle ground infested with "sluice robber," or that containing a large percentage of "black sand." Immense boulders of many tons' weight are quickly and inexpensively disposed of. In all cases the work is performed thoroughly, economically, and in immense quantity; in fact, nearly every one of the hitherto insuperable obstacles to placer mining has been met and overcome in this combination of machine and electrical agency, which seems well qualified to give value to many a mine now a burden and a loss to its owner.

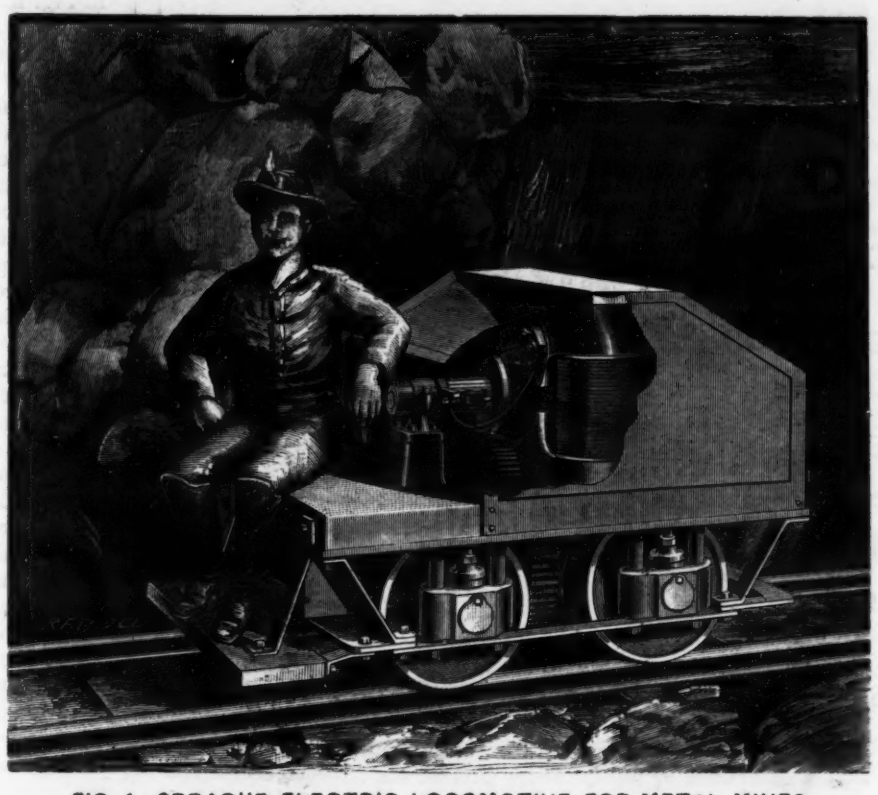


FIG. 1.—SPRAGUE ELECTRIC LOCOMOTIVE FOR METAL MINES.

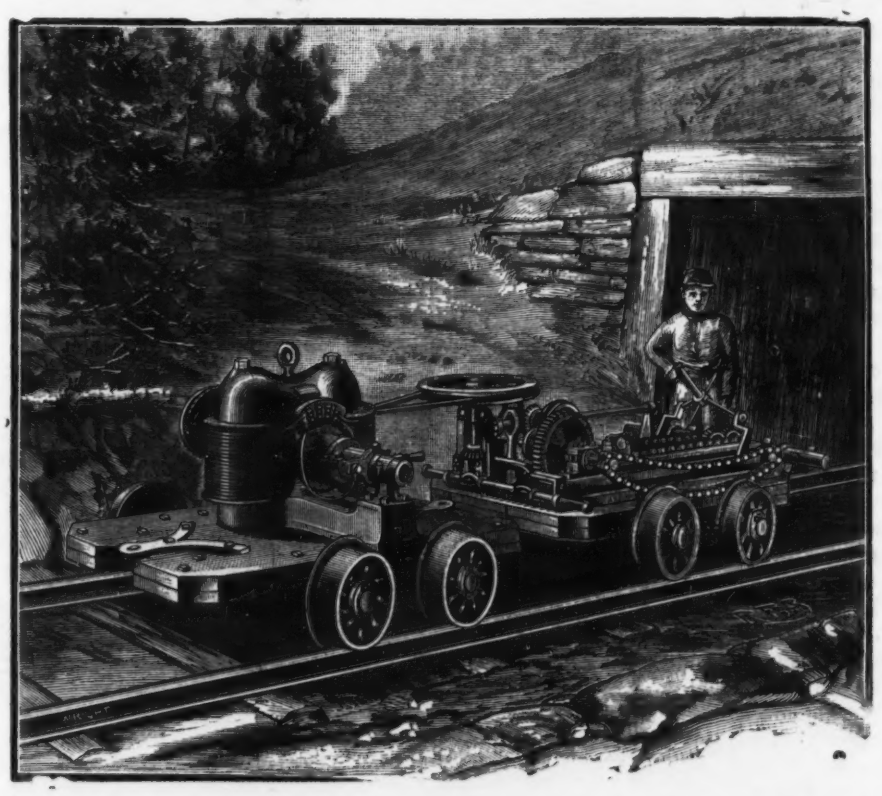


FIG. 2.—THE STINE-SMITH COAL CUTTER, OPERATED BY SPRAGUE ELECTRIC MOTORS.

The plant is entirely automatic, therefore operated very cheaply. Its principles are gravitation, amalgamation, and electricity. It can be worked successfully almost anywhere where gold is found, and where a small amount of water can be obtained, as we have said; it does not require descending ground, or what is known as dump ground, but it will work the high banks, the level plain, or the river bed. It requires but 82 inches of water, and where water is scarce it can be worked successfully with ten inches by using the water over and over.

It will extract or save *all* the free gold, including that which is so fine that it is held in supension in water; and this is of great importance, for in most places where gold is found a large percentage is very fine; often more than one-half is so fine that no other process known has been able to save it. The hydraulic process, which has been the most successful, only saves from five to twenty-five per cent. of what is in the ground, while the "Bennett amalgamator" saves at least 80 per cent.

Thus the "Bennett amalgamator" changes entirely the celebrated formula of profit in gold mining given more than half a century ago by that most eminent authority, Prof. Benjamin Silliman, of Yale, which was this: "That in all the gold mining operations of the world in the aggregate, there was a total loss of 50 per cent. of the precious metal, as originally held in its natural conditions. Of the remaining 50 per cent. the expenses of securing one-half of the same were as great as the values obtained. And on the remaining 25 per cent. there was only a margin of *profit*, which was greater or less, according to the conditions of the mining operations."

In Fig. 6, page 6, we have a view of the Huntington centrifugal roller quartz mill operated by Sprague motor. Fig. 7 shows a three-stamp prospector, similarly operated. The ease with which this stamp can be moved about, set up and operated makes the application as exhibited in the cu very valuable. Fig. 8 is a drawing from a photograph of a Sprague motor operating a pump, for mining work in Butte County, California.

There is, probably, no more universal or essential element in the equipment of a mining plant than the pump, for, unfortunately, the presence of water in mines is one of the principal difficulties to be contended with. For the operation of pumping apparatus not only on the surface, but especially underground, the electric motor is an ideal source of power. The adjustments demanded by the cramped situation in mines call for special designs, and these have been very happily worked out in the combination motor and pump. Fig. 10, page 7, designed by Mr. I. E. Storey, and exploited by the Sprague Company. This pumping plant, which is designed for 50 h. p., occupies a total floor space of only 40 × 84 inches, and stands 48 inches high. For a power pump, therefore, it is exceedingly compact. As will be seen, the motor is geared to the pump by but a single pair of internal gears, the whole, in practice, being covered so as to prevent the entrance of dust, and as a protection against falling debris.

One of the principal novelties in this combination is the pump, which has four cylinders. The individual piston speed is 73 feet per minute, and hence the wear and tear is reduced to a minimum, notwithstanding the high output of the pump.

The cylinders are made interchangeable, so that the pump can either be operated to deliver a large quantity of water at a small height or a lesser quantity to a greater height.

To effect this change it is only necessary to remove the caps in the side of the inclosing case, withdraw the pistons and then the cylinders, and substitute others corresponding to the purpose required.

While eminently adapted to mining purposes, the combination illustrated is also admirably suited for a fire pump in connection with buildings where current is available, and we may add that several pumping plants of this type have already been ordered for this purpose.

The next piece of apparatus we show is the new electric mining hoist, now being built by the Sprague Company. The general arrangement of the two different parts can be understood very easily from the view given in Fig. 9, page 7. Direct gearing between the armature and drum is used, and all gears are boxed in iron cases to protect them from dust or stray stones. At the same time the cases can be quickly removed if occasion should require to reach the working parts. Every part of the machine is designed to give the greatest power with the least weight, and by this means the machine is made quite light and can be easily transported from one part of the mine premises to another.

The qualities of durability, compactness, ease of operation and minimum of wear, so essential in mining work, have been carefully attended to in this machine. The view presented shows that no extra room is taken up by any part of the apparatus. Everything is arranged to fit closely upon the base frame of the hoist.

The speed of the motor is controlled by a regular Sprague switch at one side, by means of which the motor can be made to vary its speed by a single movement of the switch handle. Turning the handle to one division will make the motor run slowly, through two divisions faster, and full number of divisions at full speed, while turning the handle in the opposite direction give similar rates of speed with opposite direction of motion. This electric hoist is supplying a long-felt want in mining and mill work, where a convenient and portable hoist which can be operated from a lighting circuit already installed has been needed.

In all mining machinery, with the exception of the rock drill, applications of the Sprague motors are made by gear or pulley. The Sprague Company now have ready for the market a rotary diamond drill, Fig. 11, page 7, and a percussion drill, operated by a direct current, with an excursion of three inches, and which will admit of an applied energy of from one-half h. p. to 10 h. p.

These drills are economical in price, light, and simple in construction, easily controlled, and not liable to injury from the rough handling of the mine. They can be operated anywhere where a hand drill can be used, in all mining operations, as well as for plug and featherwork in stone and marble quarries.

Taking their place with the other electrical applications of the mine, they will enable the manager, if he choose, to perform *all* his mining operations by the transmitted energy of some waterfall one to 20 miles away.

In Fig. 12, page 8, we give a view of a rotary "wet jig" operated by a Sprague motor, and of which the method of connection, etc., can be understood at a glance. As will be seen, the whole apparatus occupies the minimum of floor space and is accessible in all parts.

We have dealt so far with work in or around the mine, but as our readers are aware, it is often necessary to transport ore, supplies, etc., considerable distances and over much uneven ground. Here, again, the flexibility of the electric system is seen in its application to what is called the "suspension transportation" for mining work, Fig. 13, page 8. It consists of two stationary steel cables, suspended one above the other, between posts of wood or metal, 50 feet and upward apart, and at such an elevation from the ground as not to interfere with surface traffic.

The cars run on wheels and are suspended between the upper and lower cables, the upper cable carrying most of the weight. The upper cable is connected with the positive, and the lower with the negative, side of the circuit. By contact of the wheels with the cables the current is conveyed to the electric motor in the car, imparting motion to the wheels by gears. The cars are of any pattern, material or dimension suitable to the service, and can be run at from four to twenty miles an hour in any weather at any season of the year.

After this exposition of the methods and apparatus approved, employed and manufactured by the Sprague Company, we need add nothing, though much might yet be said, to show how thoroughly prepared it is to undertake work of the heaviest and most exacting nature in the great new field of electric mining.

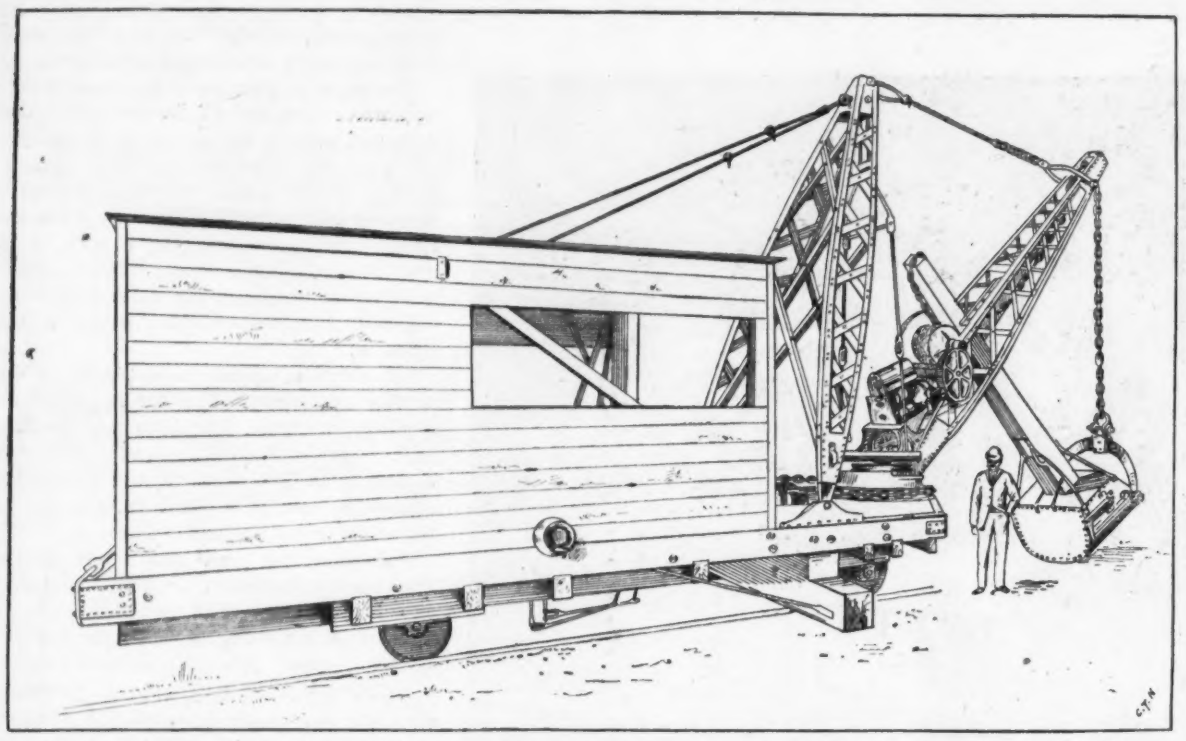


FIG. 3.—SIDE VIEW OF OSGOOD DREDGE, OPERATED BY SPRAGUE ELECTRIC MOTORS.

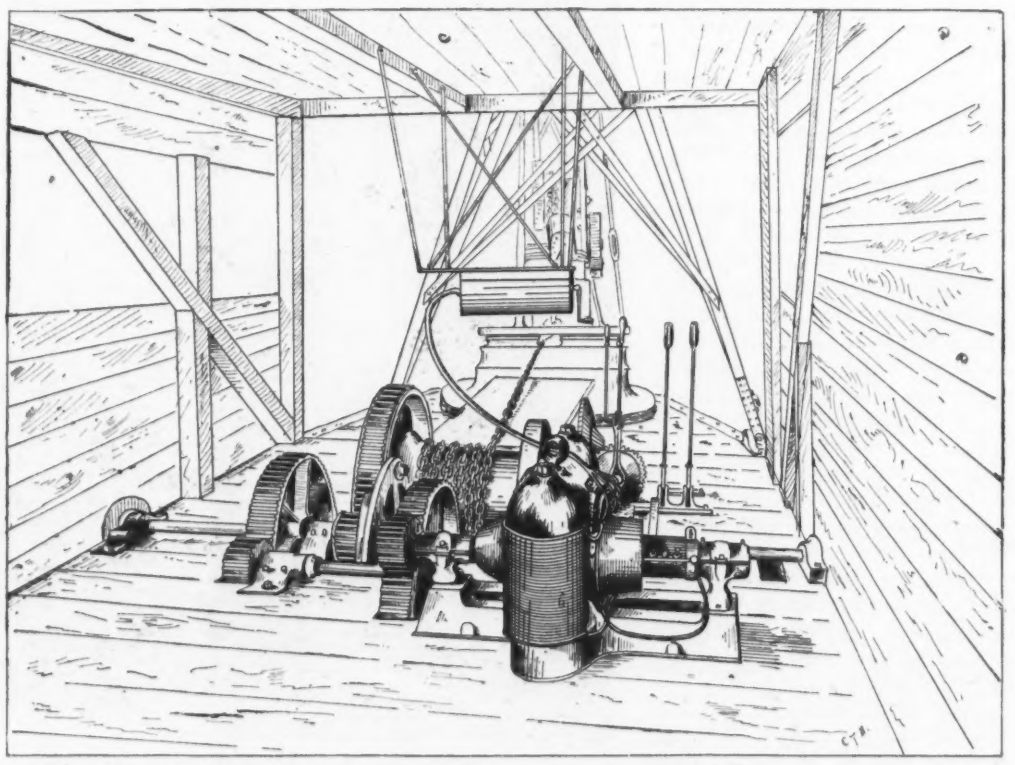


FIG. 4.—INTERIOR VIEW OF OSGOOD DREDGE, OPERATED BY SPRAGUE ELECTRIC MOTORS.

## The Use of Electricity in Mining.

BY COL. C. W. JENKS.

In the discoveries and progress of to-day, in all departments of investigation, nothing is more startling and interesting than the rapid advance made by electrical science and application. In the divisions of the subject, no single one, perhaps, has greater interest and value to the general public than that of electricity as applied to the production of power, for all industrial purposes.

It may be that the energy of some ample wasting water power is wanted miles away at a point where it can be properly and profitably utilized for mines or mills, in all their various wants and applications. The function of electricity in its relation to the production of power is simply and solely that of transmission; and so there are two uses for which it is especially applicable, and where its economy, usefulness and great value have been most fully and practically demonstrated.

These are, first, to make available sources of energy which, on account of location or for other reasons, have heretofore been unimproved or inaccessible.

Second, to distribute energy in independent units for varied uses to points widely separated, with a safety, convenience and economy not heretofore gained by the use of steam pipes, air compressor plants, wire rope, etc.

Electricity has the great advantage of being extremely portable and elastic. It also has the greatest capabilities of having its direction and intensity instantly changed. It is carried from generator to motor on comparatively small, easily-handled copper conductors, which can be laid in any direction, and to any point desired; while no force is seen or felt in the wire, such as appear in shafting or belting, or in pipes conveying air, steam or water. There is no noise, smoke or dust in the transit, and nothing to expand or contract, explode or give way, and the power is under perfect control. The same circuit which will give 100 h. p. may be tapped at any point to run a sewing machine. There is another advantage, incident to all methods of power production, but which in the electrical tr nsmission of energy is greatly increased and made more reliable. It comes to the power producer when his distribution of energy is for miscellaneous industries and over a wide area.

We will give an illustration; we will suppose that you are in possession of a large, reliable water power at such a point that, could it be widely distributed in small units for a class of industries having intermittent demand for power, its use could be made very profitable. There are within a radius of five miles from the hydraulic plant you have erected, a dozen mines with varying demands for energy of from 10 to 100 h. p. each. You run a line out, which shall take in these mines in its circuit and come back to your water wheels. The turbines at your water power belted to your electric generator pulleys produce 500 h. p. of energy. In your generators, conductors and motors on the line that deliver the current where it is wanted as mechanical energy you lose, we will assume, thirty per cent. of the power you started with, and so you deliver here and there 350 h. p. of the energy you started with at the dynamo pulley.

Now it is a matter of daily experience with electric power men in many plants where there are miscellaneous industries that are being operated that we can safely contract for and do deliver one and one-half times the amount of power we actually recover at the motor pulleys; or, taking the case in the illustration, we could safely contract for, and constantly supply, 500 h. p. to our mining customers, rather than 350. This is due to the law of general averages.

One mine, as an illustration, uses 50 stamps, requiring 75 h. p. A similar mine, two miles away on the other side of the circuit, uses the same amount in the same line; and they each pay so much per month or year for their energy. But some day, for a few hours, the stamps are hung up at one mill; and then another part of the day the other mill is idle; thus both pay for the privilege to employ the energy, but one only uses it. And so the quick release of the idle power for service, where it is wanted elsewhere on the line, enables the power producer to contract for power in excess of his actual capacity to deliver, and the average use makes it to his profit.

We may say that the thirty per cent. loss is assumed. In actual practice, we give an efficiency of from forty to eighty per cent. of the primal energy, as circumstances in the wants and disposition of the customers require.

The generators take the energy which they convert into current from any source of primal energy, steam, water, wind, gas, or what not. These generators are simple in construction, having few movable parts, and are easily handled and cared for. The motors that deliver the energy are of similar construction; and in either case the machines have but two parts liable to wear or abrasion. The depreciation of both these machines, when in constant use and under ordinary care, as compared with that of a steam equipment, is about as one to four.

We may be mistaken, but it is our conviction that one of the greatest triumphs in electrical applications of energy will be found in the future—nay, has already been fully demonstrated by the present-applications of electric motors in the mining fields of the world.

The ability which the company I am connected with now possesses of utilizing cheap, wasting sources of natural energy one to twenty miles away from the point of consumption, for all mining applications whatsoever, will be the means of development of a vast amount of hitherto unproductive property. The miner will have from one source of such energy the ability to work every machine in his mine, above and below the surface, when the distance is within twenty miles, and without the intervention of an air-compressor system, or a steam plant; and thus mining operations will be conducted in the near future, with very much greater economy, safety and convenience than heretofore. This is not a matter of mere assertion; it is what we are doing every day in different localities.

But it is not the advantages that come to the miner from the ability, electrically, to transmit energy long distances, that are to be alone considered; but also the facility for the distribution of the same, with ease and economy, in all the underground operations of the mine. If it be possible, more has been gained in the use of electrical mining applications for the work below than above the surface. Very cheap energy, as in collieries, can be produced at the mine shaft, but the methods in use for its distribution by steam, compressed air, cables, etc., etc., are expensive, inconvenient, unhealthy, and in many cases very dangerous.

Tramway service, hoisting, pumping, etc., by locomotives and stationary engines, give heat, smoke, gases and great danger from fire, as do also all former methods in use for lighting mines.

Aside from the advantages in ventilation that have come from the use of compressed air and steam, in the exhaust

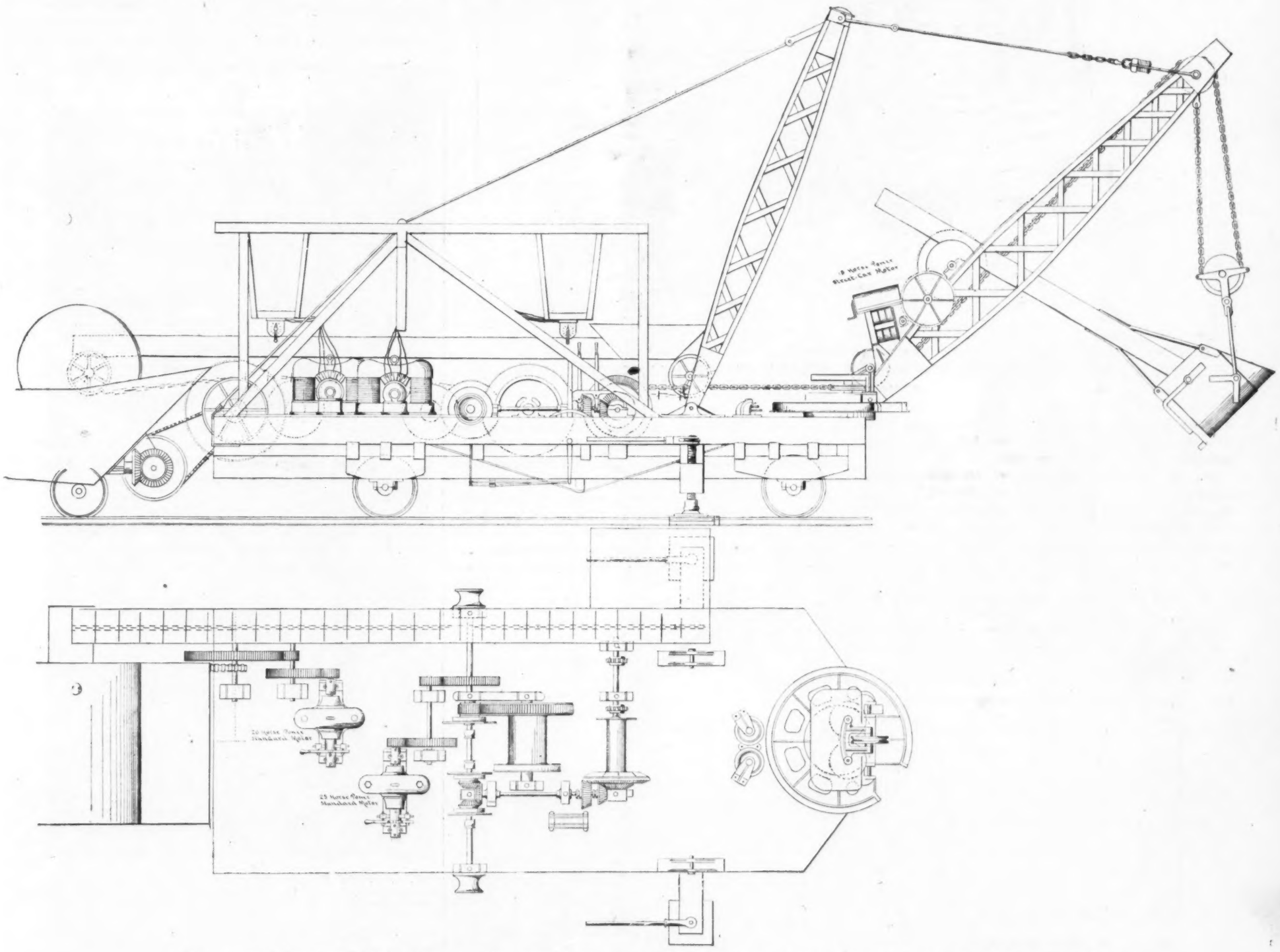



FIG. 5.—THE OSGOOD EXCAVATOR AND BENNETT AMALGAMATOR, OPERATED BY SPRAGUE ELECTRIC MOTORS.

fans, etc., the evils of that class of service are very great, in the heavy and expensive pipes, both in their first cost and in the needed changes; in their leakage, expansion and contraction; and in some systems also, in the necessity for fires at the ports, to prevent freezing; but more than all else, in the immense waste of energy, often amounting in air compressor plants, to 70 per cent. of the primal energy employed. The claimed great advantage of ventilation, in such use of compressed air, is found to be as well secured by a system of fans operated by motors from the electric conductors, giving cleaner, better and safer service in the other enumerated mining operations.

The bad atmospheric conditions of most mines are largely due to the power and lighting methods hitherto in use there. Where these are superseded by the agency of electricity, with its freedom from noise, fire, smoke, gases, dirt, etc., and its convenience and economy of application under all conditions is manifest, it will be seen to be the one most desirable and essential factor in all future mining applications, as well below the surface as above ground,

## A Few Figures on Electric Mining Locomotives.*

BY F. W. HORNE.

While we are lighting the mine it would be well to consider the question of making the mains and feeders large enough to supply the necessary power for tramming the coal, not to exceed a loss of 12 to 15 per cent. in resistance, with a full load on. Of course, in a shaft and a slope to the bottom of the dip of the coal, if over ten degrees, a stationary steam engine is the cheapest on a direct haul, as it is the first product of steam, while electricity is the second at generator and the fourth at motor. A good electric generator should give 93 to 95 per cent. efficiency. Figuring the loss in the wire circuit in

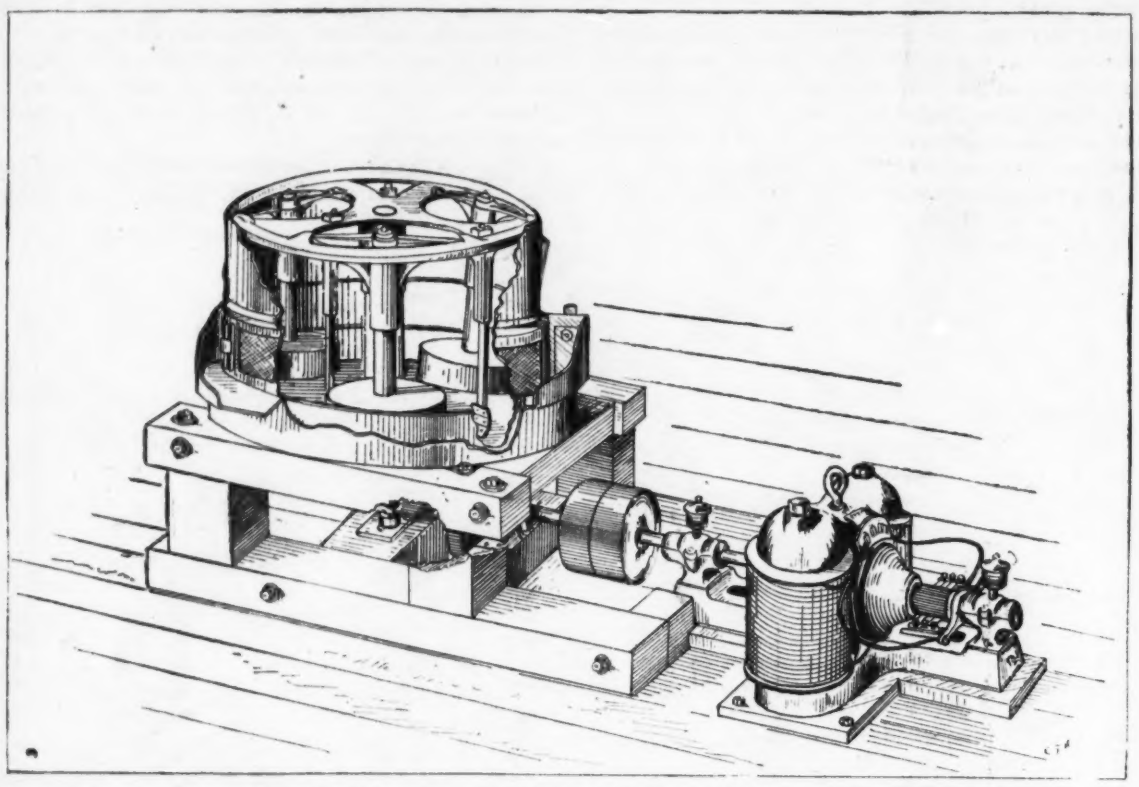


FIG. 6.—THE HUNTINGTON CENTRIFUGAL ROLLER QUARTZ MILL, OPERATED BY SPRAGUE MOTOR.

resistance at 12 per cent., conversion at the motor 10 per cent., we have a net efficiency left us to apply to the wheel of the motor car of 71 per cent.

The size of the wire necessary to carry the current any certain distance can only be given after accurate measurements and amount of load to be carried are stated. The size of the motor to haul such loads as we have stated is estimated at 5 h. p., net, delivered at the wheels, which would consume from a generator, allowing 29 to 30 per

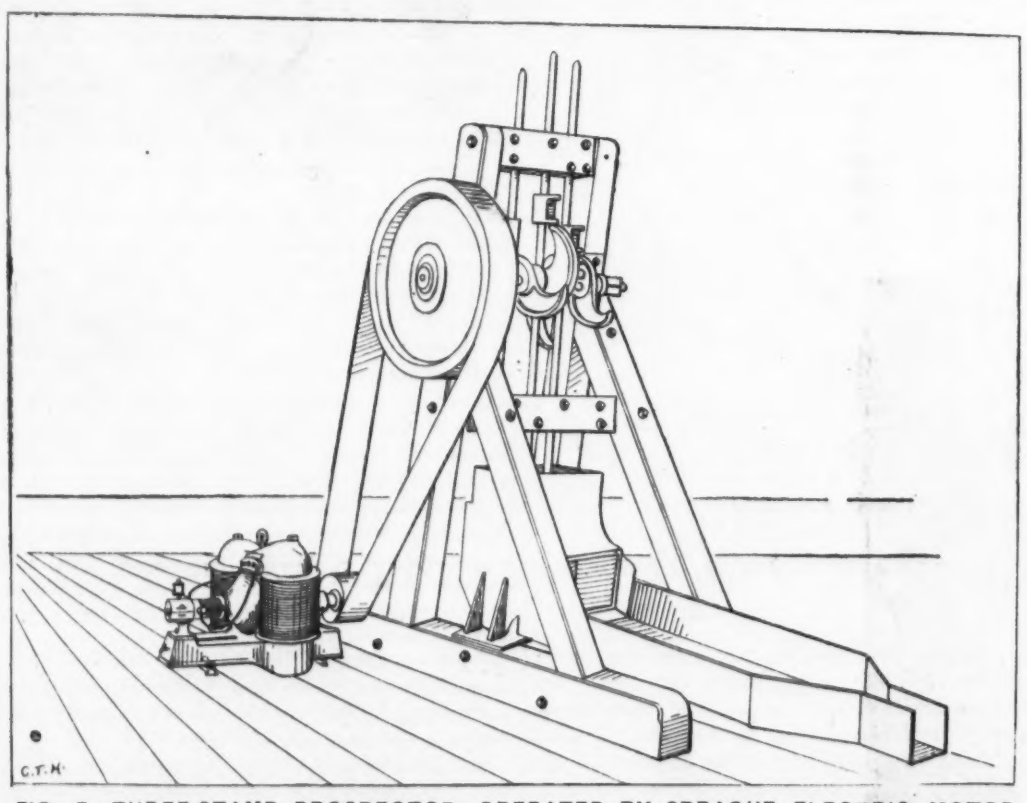


FIG. 7.—THREE-STAMP PROSPECTOR, OPERATED BY SPRAGUE ELECTRIC MOTOR.

cent. for loss, 6½ h. p. Figuring coal at 75 cents per ton, and six pounds of coal consumed to the horse power per hour, we find a total consumption for the day's work, ten hours, 390 pounds, or a total cost of 15 cents. We calculate that this motor will do the work of three mules and three men. If we simply take into consideration the consumption of coal by the motor, and the feed of the mule for a month, we find that we feed the motor, for 26 working days, $3.90 worth of coal. It is not necessary to have an expert to be capable of running this

* Abstract from the *Black Diamond*.

proper state. The cost of the motors varies in accordance with the system you select. It is well, however, to bear in mind that the cheapest is not always the best. Like the majority of cases, the cheapest is the dearest in the end. At the present time 5 h. p. motors can be purchased on the open market for $550. To this we have to add the special gearing, costing from $150 to $200 per car, and also the woodwork, which has to be strong and durable. The height of the car can be as low as desired, so that a man in a sitting position on the floor of it would not measure, from the ground to the top of his head, over three feet and six inches, and, if desired, could be made even lower than that. The car should also be provided with reversing gear, so that it can run in either direction, by simply the reversing of one lever. The car should be made so as to either push or haul, as the case may be, in order to avoid numerous delays and profanity that is caused by the miner's car getting away from him, and coming down loaded in front of the mule, when the trammer finds it impossible to lift his mule over the car and not room enough to go around it; and as the mule will not shove it ahead of him, the trammer necessarily calls all hands within hearing to leave their work in order to surround the car and shove it back uphill, into a room to permit the trammer with the donkey to pass. It is a question that will have to be decided in each individual case, as to whether it is desirable to extend the motive power so that the motor car can deliver the cars to the face of the coal in the miner's room, seeing that the distance of the headings is arrived at, by the imagination of how far the miner will push his car without kicking. Where there is a steep grade, it is sometimes necessary to bring the headings very close together, making the life of the rooms very short and having the additional expense of driving a heading and turning rooms, when at least 50 per cent. of it could be saved if the cars could be delivered to the face of the coal and avoid one-half of the disputes that arise between miners and their employers. The strength of the current to carry into the mine is a question that is to be determined. The higher the electromotive force, or pressure, the smaller the conductor or wire circuit. Seeing that the contact to supply the current for the motor must be taken from overhead, while, possibly, one wire is connected with the rails, it would not do to have the current of sufficient strength to injure a party accidentally coming in contact with it. We would, therefore, recommend that the strength of the current be such as to knock down a good-sized man if he persisted in handling it wrong. We think with such a current

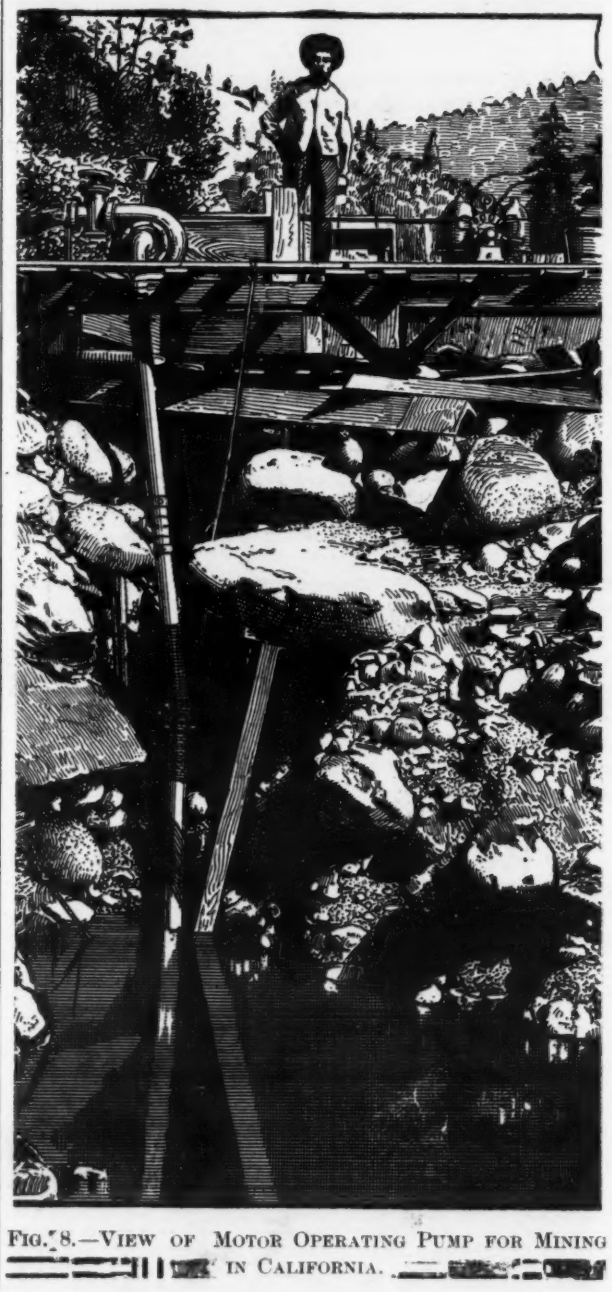


FIG. 8.—VIEW OF MOTOR OPERATING PUMP FOR MINING IN CALIFORNIA.

we would be on a par with the average mule, and that there will be no preference as to which he has been kicked by. The size of the generator depends entirely, of course, on the amount of work or current that it is to supply, while we have so far only considered the use of electricity for motors connected with tramming and lighting. The means of ventilation in mines have been discussed thoroughly and ably in this journal from time to time, and there seems no doubt whatever but that the rotating fan is the best form. Yet, at the present time, mining engineers have found it necessary to place the ventilating shafts near the slope on account of getting the necessary steam to supply the engine driving the fan, or else go to the additional expense of erecting a complete steam plant to operate a 10, 15 or 20 h. p. outfit. However, with the electric motor, the ventilation shaft can be placed any distance desired from the main slope, doing away with boilers, engines and attendance, making it the cheapest known power in existence for ventilation. There are to-day hundreds of mines that would abandon the present furnace and substitute the rotating fan, if they would simply investigate the merits of driving the fan by motor in place of steam plant. Within the last year the electric motor has also been applied to coal-cutting machines as well as drilling, and has met with all the success that could be desired

for the limited time this matter has been taken up, and to-day is working in a practical and efficient manner. It seems, however, that many improvements could be made in this line; that, instead of utilizing the rotary motion, they would use the power in the form of a magnet to repel and attract, which imparts the motion similar to that of a pick in a man's hands. The motor can also be used to great advantage for pumping water for various purposes, wherever desired, generating the current at the mines. The writer can call to mind a coal mine where the water is a little less than sulphuric acid. In order to get pure water for the boiler it was necessary to locate a pumping station with steam outfit nearly half a mile from the slope, and for this small power it was either necessary to carry the steam there through a pipe, losing 75 per cent. in condensation, or erect a boiler and employ a man to run it; while with the electric motor the work could have been accomplished by an expenditure of one-third the amount and a saving every day that it ran, by doing away with constant attendance to the boiler to run the pump. There is hardly a place around a mine that electricity cannot be used in one way or another to great advantage. It will not be long before the mines will be completely equipped with electrical apparatus to give any warning that may be necessary for the miners to come to the surface, and there is no question at all but that many accidents could have been avoided, saving scores of lives, if electrical devices had been more liberally used throughout the mines. The question may be asked, "Are there parties ready to undertake such contracts to equip a mine thoroughly?" The writer can say positively that they are ready and willing, only waiting for the opportunity, and it is now the question, simply, Which will be the first?

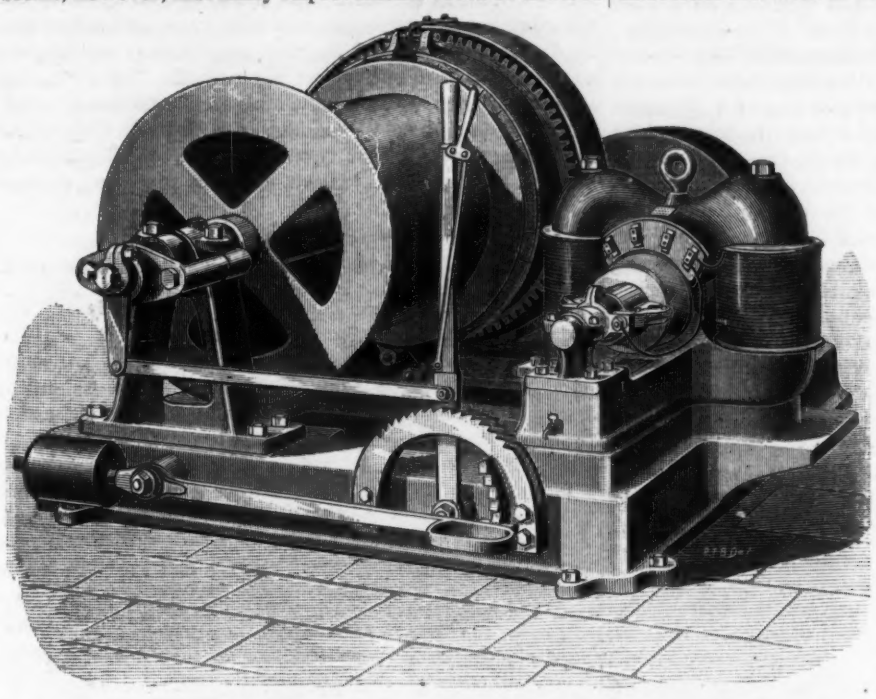


FIG. 9.—FIFTEEN HORSE POWER SPRAGUE ELECTRIC MINING HOIST.

## On the Conditions of Efficiency in Electrical Mining Machinery.

BY DR. LOUIS BELL.

A few months ago I remarked that electric street railway service was perhaps the hardest work to which an electric motor could be put. I am glad now for that saving word "perhaps," for the growing use of electrical mining machinery presents a task far more difficult. All the difficulties met with in street railway service, dampness, variable load, dirt and dust of every kind, lack of proper continued attention, are aggravated in the case of mining machinery. Consequently every precaution necessary in the former case is doubly necessary in the latter. Efficiency in such a case as this means something more than the ratio between power supplied and power delivered. An electric mining locomotive, for instance, has to work under conditions far more severe than are ever met with in ordinary electric traction. The grades to be taken are sharp and likely to be anything but smooth, curves must sometimes be made in a very contracted space, and the road bed and track must often be rough. In addition to this dirt and dampness are met with to a very serious extent. Consequently we cannot hope for a high commercial efficiency.

In electrical coal diggers and drills of various sorts the difficulties to be encountered are even greater, for the motor must work on all sorts of insecure foundations, or no foundations at all, in all sorts of positions, and in the midst of the dust and dampness of a fresh cutting. What I specially wish to point out in this note is that nearly all the considerations of electrical efficiency must be subordinated to two objects—strength and durability. No amount of efficiency in the motor can make it successful if it lacks these two things. A mining motor, meeting as it does decidedly rough usage, must be thoroughly reliable. A low electrical officiency can be made up for by a few pounds or hundred-weight of fuel at the power station. Nothing can compensate for the annoyance and expense of a burnt-out motor in the midst of a busy day's work. As a motor may replace the work of several men, so a break-down in that motor produces a correspondingly serious break in the operations. Aside from the actual loss the manufacturer must remember that the moral effect of accidents is out of all proportion to their real effects. Low efficiency may be tolerated even willingly, but a series of break-downs produces a general feeling of insecurity that is disastrous.

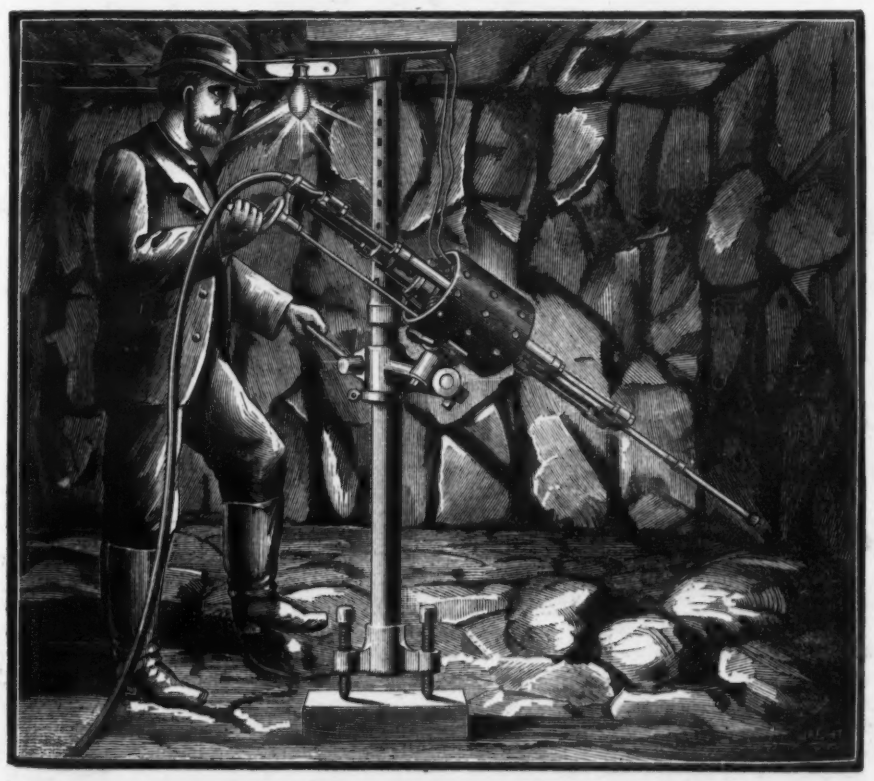


FIG. 11.—THE SPRAGUE (STOREY'S PATENT) ELECTRIC ROTARY DIAMOND DRILL.

The distribution of power from a central station to all the portions of a distant mine by any of the methods in use up to the present involves so serious a loss that electricity need fear no severe competition on the ground of efficiency. Consequently the point to be aimed at in building electrical mining machinery is to make a strong, well-insulated motor, easy to manage and to repair and which will do the work required. If the armatures and fields can be made thoroughly water-proof and able to withstand a reasonable amount of heating, the question of electrial efficiency may be put aside for the present. When a motor has been built that will do this rough mining work and do it without the necessity of frequent attention or repairs, it will be time enough to look for a theoretical efficiency.

In one sort of mining machinery, the general class of motor drills, one other condition must be met. In addition to being strong the motor also must be sufficiently light to permit of ready moving and manipulation. For instance, a rock drill capable of doing even light work, light enough to be handled by a single man and reasonably reliable, would meet a long-felt want. It would be policy to secure this lightness, even at a further loss of theoretical efficiency. Such machinery is built to do work, not to illustrate ideals.

To recapitulate, the desideratum in mining machinery is strength and reliability; nearly everything else can be subordinated to securing this end. Strength of the moving parts and insulation of fields and armature are the points to be looked at in designing motors for this class of work. If the electrical efficiency is not so low as to endanger the coils through heating, we need pay it but little attention, for we do not have to compete with very efficient methods of distributing power. Once convince the public that electrical mining machinery can be trusted to do its work and is not likely to break down and leave the miner in the lurch, and the future of this branch of applied electricity is secure. From the progress that has already been made we may feel sure that the time for a general use of electricity in certain classes of mining work is not far off, and I can only hope that these few suggestions as to the kind of efficiency to be aimed at may hasten the day. Once secure the efficiency that means practical, reliable, every-day work, and theoretical efficiency will come in due season.

## Pennsylvania as an Electrical Curiosity Shop.

Mr. E. R. Clemence, the secretary of the Underwriters Association of the Middle Department, has issued to its companies and members the following interesting and sadly instructive report made to him by Mr. A. E. Braddell, his electric lighting inspector:

Since leaving Philadelphia, Oct. 8, according to instruction, I have examined 57 electric light stations and isolated plants, and made a hasty inspection of the condition of wiring in these places.

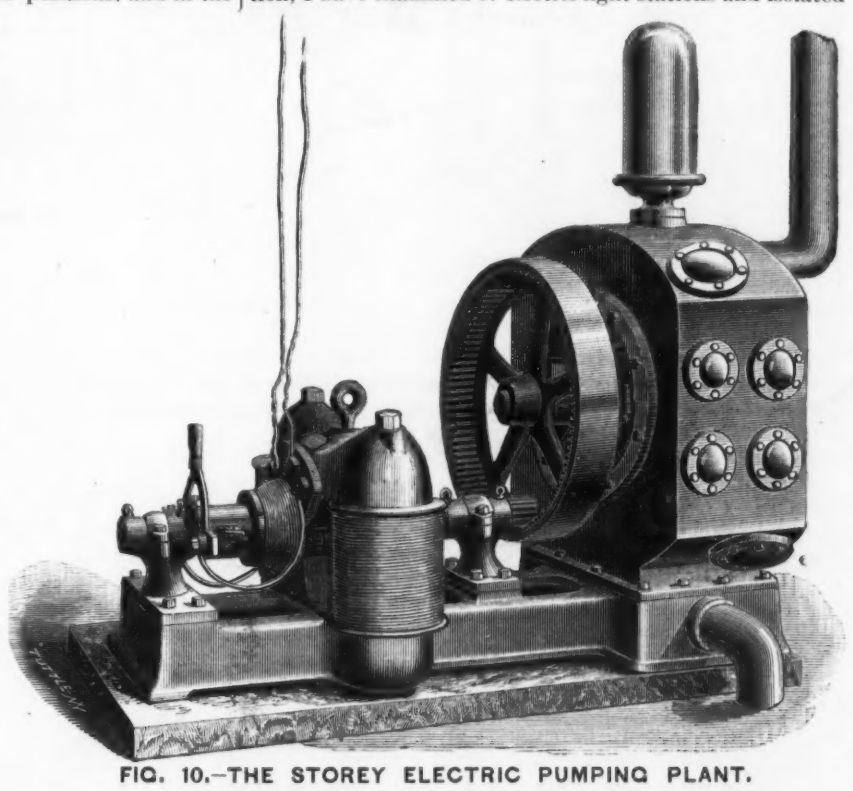


FIG. 10.—THE STOREY ELECTRIC PUMPING PLANT.

Taken as a whole the work is poor, especially the running of wires. This is done in a very loose and careless manner, having no regard to rules for the prevention of abrasion to insulation, or proper uniformity in running the conductors. Where concealed work is placed in new buildings, there appear to be no precautions taken with regard to safety from fire, the wires being placed on the joists, etc., with wood cleats, passing close to stonework, and through plaster; also brought through the same opening with gas pipes, relying entirely on insulation of wire. In a great many places underwriters' wire is used for this kind of work. This wire is, of course, used to a great extent by all the companies, and where it is placed in thoroughly dry places, and put up in a careful manner, I do not think it is to be feared as a fire-causing wire.

At the same time, I was glad to be informed that all those in charge of the different plants are replacing, or intend to replace, this wire by one of the many superior insulations at present in the market.

Metal staples are used to a great extent, both for inside and outside wires. By the latter, I refer to those which are brought from the poles and fastened to the buildings before going inside. In one central station I found a good rubber insulation torn by these staples, and in one or two places worn through the insulation in actual connection with the conductor. In some places there are metal staples being used with a piece of rubber or leather between them and the insulation of the wire, but as we are unable to tell the qualifications of the men doing this work, Rule No. 28 cannot be too rigidly enforced.

The wiring of fixtures is another source of trouble on account of badly insulated wires, and the absence of any kind of bushing. This is more especially the case with reference to the pieces of gas pipe used in many places for holding incandescent lamps.

I was told at one of the stations that there were a great many short circuits caused in this manner, and that they merely put in some new wire, but took no precautions to prevent the same trouble from occurring again. I am also told that the fixtures, which are bought from the manufacturers, are wired as small as No. 20 B. & S., with the remark that if they (the manufacturers) do not know the underwriters' rules, it is hard for the companies to conform to them.

In stations where bus wires are used, I found, with few exceptions, all fastened to the woodwork with wood cleats or metal staples; in one station they go so far as to conceal them in molding. I did not notice any sign of overheating in these wires except at one plant, where they had charred the woodwork against which they were lying.

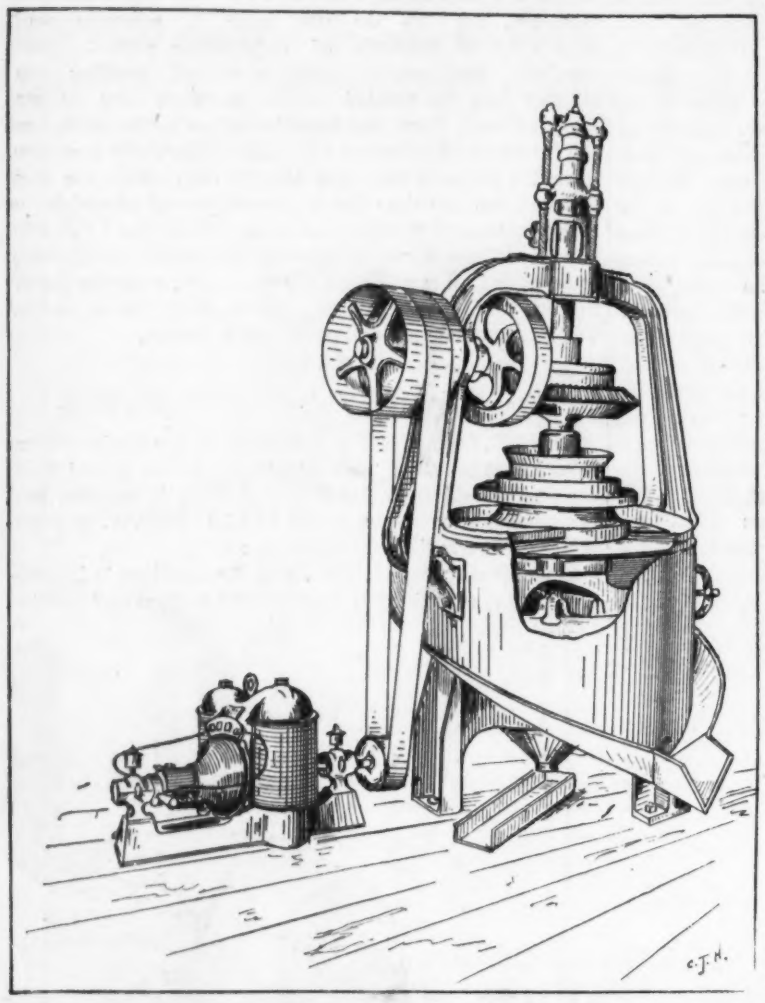


FIG. 12.—ROTARY WET JIG, OPERATED BY SPRAGUE ELECTRIC MOTOR.

With regard to feeder equalizers, they are all constructed with wooden frames, with the exception of one station, which has two with iron frames, and the connections from coils pass through porcelain insulators. These do not conform to the rules in any manner, and they appear to be a source of trouble and annoyance, so much that they are endeavoring to balance their circuits as much as possible, in order to dispense with them entirely.

The dynamo machines, as a rule, are well insulated and well attended to, with one or two exceptions. An attendant at one of the stations said he could not adjust his brushes without getting a pretty fair shock. This was quite apparent by looking at the flooring on which the machine stood and the condition of wiring.

I found one machine in an isolated plant *insulated* (?) as follows: A brickwork foundation, on which is set a stone slab, and the bed-plate of machine bolted on to this. I was told this work was done by an expert of eight years' experience, and when I explained to him how the machine should be set, he informed me that stone was a better nonconductor than wood.

In stations using alternating systems, there are converters placed inside the buildings for lamps used in the stations, and some are placed on the switchboards in conjunction with the voltmeters, and have wood frames. These, according to Rule No. 64, should be placed on the outside of all buildings. In some places there are arc lamps without a "hanger board," hanging solely by their leads I also noticed very few cut-out switches in circuit with lamps entering buildings.

The soldering of joints, which is most important, not only on account of decreasing the electrical resistance, but also as a prevention from fire, is not attended to as it should be. I found some joints with very bad connection, especially T-joints, which I could move through the space of one inch.

I may here add that I was most cordially received by all connected with the respective companies, and was assured that they would co-operate with this Association in every way to further the interest of electric lighting.

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The work thus begun by Mr. Braddell will be systematically kept up.

## The Price of Copper.

With regard to the prospects of the copper market, the *Mining Gazette* says:

Regarding the copper situation, the reports from all sides are of a most encouraging nature, leading those who are best posted on copper affairs to believe that for the year 1890 the tone of the copper market is to be a most healthy one. It is now reported that the French copper syndicate holds less than 130,000 tons, and that it is their intention to hold the price of the metal at from £50 to £55. Also that the visible supply decreased in November some 5,000 tons. Should the copper abroad be held at this price, and the visible supply continue to decrease at the rate it did in November, or faster, it will lend a strong tone to the market. A fire, too, in a great mine, such as the Anaconda, cannot help but have a beneficial influence on the copper market. While such a catastrophe is deplorable to the highest degree, and we all hope it will be of short duration, yet the withdrawal of some 5,000,000 or 6,000,000 pounds of copper per month during the time that the mine is closed is certainly a large factor in the situation. Not only is it, we understand, the intention of the foreign bankers to hold their copper at from £50 to £55 per ton, but reports point very strongly to the fact that the producers are sold out for some months ahead, and that there is little or no floating copper on the market in the hands of speculators. The above facts, taken into consideration with the fact that the demand for the metal is not only very large in Europe, as well as in this country, would point very strongly to the idea that the future prospects of the copper situation are of a most encouraging nature.

## The Specific Resistance of Amalgams of Sodium and Potassium.

In these investigations, says Professor Grimaldi in *Il Nuovo Cimento*, I determined the electrical resistance of several amalgams of sodium and potassium of different degrees of concentration, with a view of ascertaining their chemical constitution. The determinations were effected either by the Wheatstone bridge or by Kirchoff's method. The amalgams were contained in U-shaped glass tubes, and minute precautions were taken in drying and in filling the tubes. I noticed that amalgams rich in sodium and which solidified had a specific resistance less than that of pure mercury. But if the resistance of an amalgam is determined at 0 degree C. before and after heating, its latter resistance is found to be higher. This permanent increase in resistance is proportionate to the intensity of the heat applied and to the duration of its application. This would seem to indicate that these amalgams are composed of two distinct parts, which are separated by heat. Liquid amalgams containing but a small amount of sodium, and prepared by the direct union of the two metals, have a higher specific resistance than pure mercury. The resistance of two amalgams, one of which contained twice as much sodium as the other, was found to be the same. On the other hand, the resistance of liquid amalgams, obtained by dissolving crystalized $Na_4 Hg_{12}$ in mercury, became less as the quantity of sodium was diminished. This difference leads one to suppose that there exists a definite liquid amalgam containing a small amount of sodium, which is confirmed by the fact that two amalgams, equally rich in sodium but prepared by two different processes, showed different resistance.

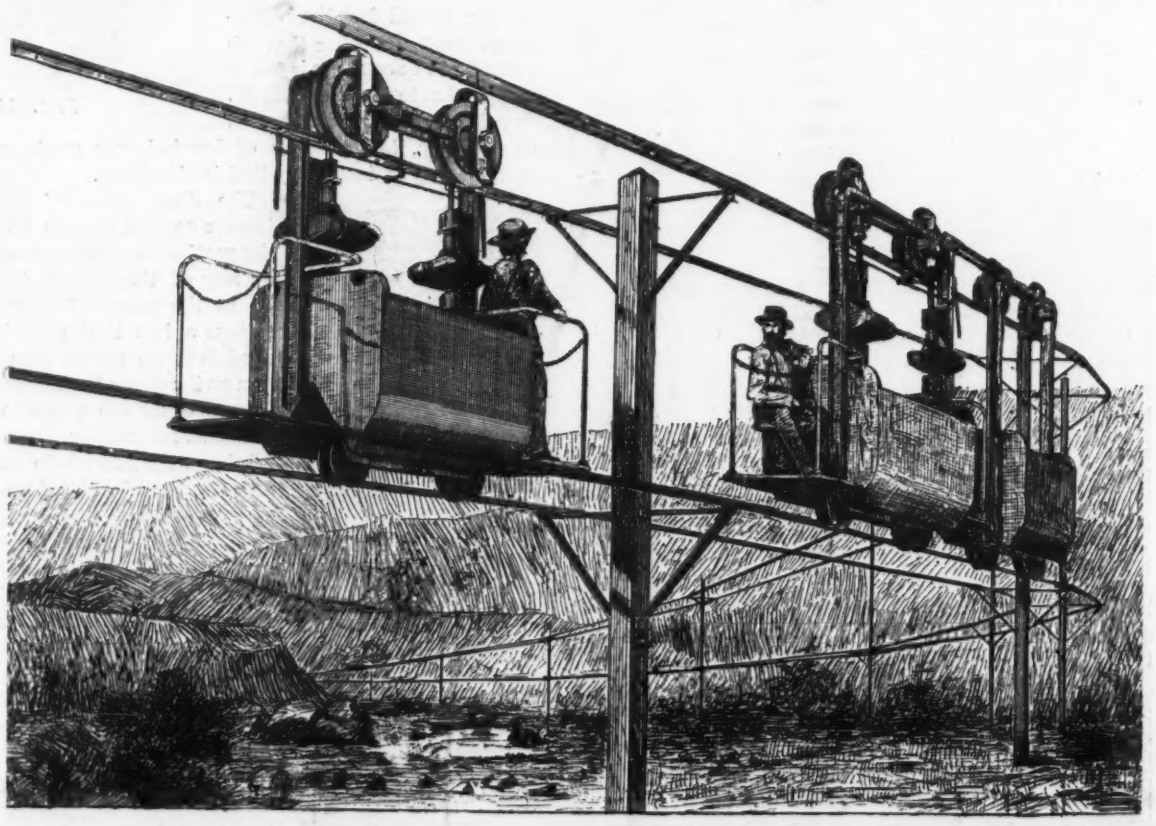


FIG. 13.—DOUBLE TRACK ELEVATED ELECTRIC WIRE ROAD FOR MINING AND MILL PURPOSES.

## Presentations in the Commercial Cable Company.

There were bright and happy faces in the offices of the Commercial Cable Company on the afternoon of the 24th of December, and not in New York only, but on both sides of the Atlantic; for John W. Mackay, the president of the company, had put a girdle of gladness about the earth in something less than forty minutes.

Mr. Mackay had simply done what he has done every year since the Commercial Cables were opened, but what never fails to fill the employés of the company with grateful hearts. He had sent an order to General Manager Ward, instructing him that every employé of the cable company, from the lowest to the highest, should have a Christmas present of a half month's pay. Over three hundred men and boys were made participants in this handsome gift, which, it is said, costs Mr. Mackay about $15,000. The money does not come from the company, but from Mr. Mackay's private funds.

On X'mas Eve Mr. George Clapperton, the New York superintendent of the Commercial Cable Company, was the recipient of a beautiful alligator traveling case with solid silver fittings, from the members of his staff. His initials were engraved on each article. It was a complete surprise to Mr. Clapperton, and in a letter of acceptance he feelingly acknowledged this kind expression of good will.

Mr. Frank H. Dennis, Chief of the Clearing House Department of the same company, was also presented by the clerks in his division with a Christmas gift in the shape of a handsome meerchaum cigar holder accompanied by an appropriate letter.

Mr. S. F. Austin, New York superintendent of the French Cable Company, found on his desk on Christmas Eve, just before leaving his office, a fine massive onyx parlor mantel clock, which his staff asked him to accept with cordial Christmas greetings, and as a slight mark of the esteem in which they held him.

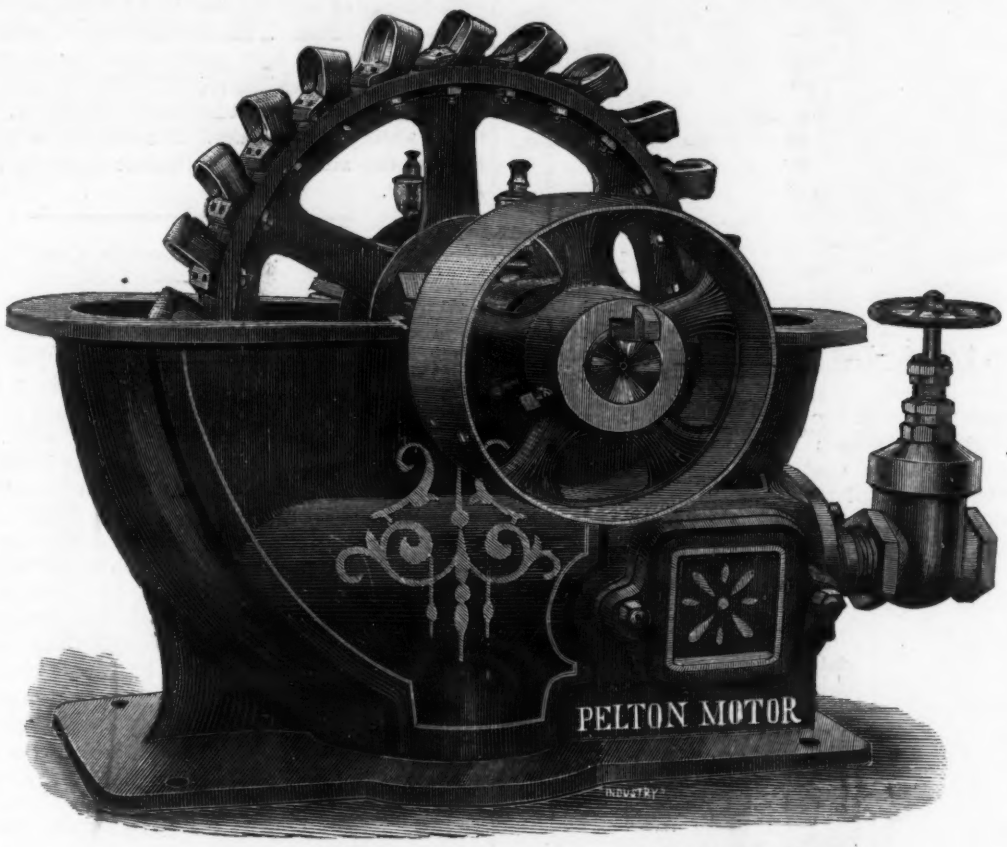
## Death of Pacinotti.

Prof. Luigi Pacinotti, well known in electrical circles, has just died in Pisa. He was born at Pistoia in 1807, so that he was in his eighty-second year. Almost from his earliest youth he manifested peculiar aptitude for the study of mathematics, and up to the year 1831 continued his studies at the college of Pisa with extraordinary assiduity, obtaining in that year the chair of experimental physics in the university. Pisa owes to him the world-wide status in the scientific progress which received the eulogiums of the congress of Italian scientists which met in 1840. In 1841 great impetus was given to mathematics and a new chair was instituted, and Pacinotti received the appointment of professor of experimental science. His name is best known in connection with the now classical "Pacinotti ring."

### The Pelton Water Wheel for Electric Mining.

A few months ago we published a full account of the Brush electric power plant placed in the Chollar shaft on the Comstock lode by the California Electric Light Company.

The plant in question consists of six 120 h. p. Brush compound-wound constant-current generators, situated on the 1,600 level of the Chollar shaft. The power used to operate them is water applied to Pelton wheels under a 1,630 foot head, each generator being provided with a wheel of its own. The water is conveyed to the generators through two lines of pipe—one 8-inch and the other 10-inch—which unite at the station, and there again divide into six, there being one 6-inch to each of the wheels. These pipes are carried down the incline to the shaft and station, whence the spent water is carried off through the Sutro Tunnel to the Carson River. The station is cut in solid rock, and is 25 feet wide, 50 feet long and 12 feet high. The current is carried back to six electric motors, each of 75 h. p. Those which are in use join with the upper Pelton wheel in driving the big main shaft of the mill.




THE PELTON WATER WHEEL FOR ELECTRIC MINING.

The details of the plant we illustrated at the time. We now give a view of the Pelton wheel referred to, which has found special favor in electric mining. The six wheels in the above plant are only 40 inches in diameter, and the width of the buckets is but 2½ inches. In this instance the wheels are attached to the dynamo shafts direct, dispensing with intermediate gearing, and are made of a size to give the proper speed to the dynamos, which run at 900 revolutions. They are calculated, however, to withstand the enormous speed that the velocity of the water would give them running without load, which would be 1,800 revolutions, giving the periphery of the wheel a speed of 18,864 feet per minute, the water flowing from the nozzle with a velocity of 19,260 feet per minute. It is claimed that under this tremendous pressure there is no loss of efficiency in the wheels, the average being from 88 to 90 per cent. These 40-inch wheels are made of phosphor bronze, and each weighs 220 pounds, being capable of developing 125 h. p. with a stream of water half an inch in diameter, under the conditions, giving a total for the six of 750 h. p.

It is noteworthy that in this instance the water is made to do a large amount of work before it reaches the electric generating plant at the Sutro Tunnel level. At the surface in the Nevada mill is another Pelton wheel, 10 feet 10 inches in diameter, upon which the water falls under a vertical pressure of 460 feet; and here, as remarked, a large amount of work is obtained, the surface wheel, as already mentioned, driving on the main shaft with the electric motors.

### Lighting Fixtures as an Element in House Furnishing.

On this subject, Mr. F. W. Best, of Denver, in a recent article in the *Western Architect*, says:

Not only the design of the chandelier or bracket light should be made to harmonize with the woodwork and decorations, but the color. In place of the verd antiques and French bronzes of a decade or two ago, gas and electric fixtures are now being made in the different finishes of brass, among which are antique brass, antique copper, oxidized silver, bright or "butler's" silver, statuary bronze, polished brass, Japanese bronze, bright and dead steel, gold gilt, ormolu and others, the bodies of the metals generally being brass and the colors or finishes being made by acids and lacquers.

Nothing could be more incongruous in a room furnished in the style of the Louis, in white and gold, than a fixture finished in antique brass; yet in violation of harmony, propriety and good taste, this is sometimes done. Or the reverse, an ormolu or gold gilt fixture in a room where the woodwork is of oak (antique or light) is sadly out of place.

No rule can be given for selecting the fixtures for gas or electric light for every room, and while individual tastes are, and should be, consulted and gratified, the selections should be largely left to an experienced and competent fixture dealer or decorator.

A few suggestions, however, may be made as to rooms furnished in the prevailing and popular styles. An oak room should have lighting fixtures either in antique, polished or lustreless brass, or black iron; the darker woods—walnut, mahogany, rosewood, etc., may also have these finishes, or the different bronzes, Japanese statuary, etc. Birdseye maple, light cherry and the lighter colored woods have a pleasing effect with light from a silver fixture, particularly where the decorations are blue; but for a French room there is but one admissible finish, gold gilt or ormolu, and in no other room should the design be more distinctive. It should be purely French, though the writer has seen in such an apartment a fixture of marked Egyptian character, in antique brass. The effect can be imagined by a connoisseur.

"The eternal fitness of things" can nowhere be better observed than in selecting fixtures for lighting, and it is a subject that will as well repay study as any other part of the interior furnishing.

### Lightning Flashes as a Weapon of War.

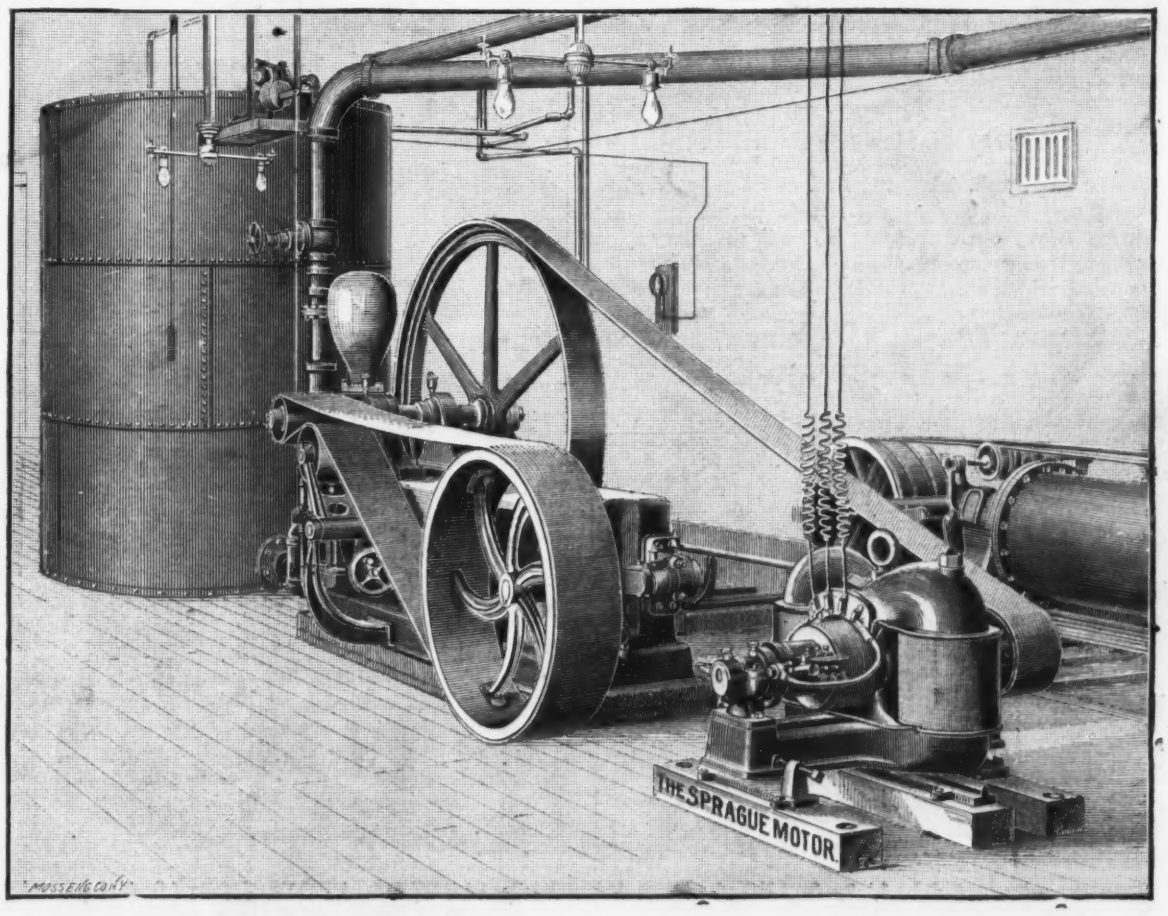
Mr. F. W. Grennell, of Trenton, N. J., writes to the *Sun:*

"I have made a discovery recently which I think will have the effect of changing modern warfare, in fact exterminate all warlike ideas. I do not propose to go into details at present, as my scheme is not yet patented, but will give a short statement of my discovery. In a word, my scheme is to produce artificial lightning. Thus far the experiments have been confined within narrow limits, but with the use of a small dynamo attached to my invention a slight shock can be produced, effective enough to kill the flies in a 20 × 20 room.

"I claim, with the use of powerful dynamos, under my plan, a flash of lightning can be directed against an army a mile or more away and without injury to the party operating the gun, scattering death and consternation among the troops. With powerful dynamos thousands of soldiers can be killed at a flash, and a number of flashes are enough to destroy an army. It can be used at any time except on rainy or damp days. If the effect of giving this discovery would be, as I hope, to put an end to war, I should feel repaid, but I dread to think of electricity being used in war under my plan. The consequences would be enormous. It means nothing less than extermination to the opposing army. Before going any further with it I would ask your opinion as to the effect upon war of an instrument such as I have hinted at. Would it retard or facilitate war?"

### An Electric Elevator Installation in Philadelphia.

We present in this issue a view of a recent model hydraulic elevator installation made at the building of the United Security Trust and Safe Deposit Company, of Philadelphia, by the Otis Elevator Company, of Yonkers, N. Y., and Chadbourne, Hazleton & Co., of Philadelphia, agents in Pennsylvania for the Sprague Electric Railway and Motor Company, of New York. One of the first things which strikes an observer is the minimum of space required for every part of this installation. The pump was manufactured by the Otis Elevator Company specially for this plant, and the arrangement for reduction of speed between the armature shaft and pump is made in the compact manner shown in the illustration. The motor operates the pump against a pressure in the tank, there being no overflow, and when the maximum pressure is reached, the motor runs empty, automatically cutting down the amount of electric current taken from the line, so that only sufficient current is used to supply the energy to keep the motor in revolution.




AN ELECTRIC ELEVATOR INSTALLATION IN PHILADELPHIA.

Before the installation of the electric motor at this place, a gas engine was used to supply the necessary power, but gas never proved satisfactory in this capacity, and the Sprague motor was substituted. This motor is now giving perfect satisfaction, and the plant is one of the finest running elevator plants in Philadelphia. The cut is made from a photograph, and shows all the details of this installation.

### Results with Electric Cars in Cleveland.

It is now one year since the first electric motor car run by the overhead system made its trial trip on Euclid avenue from Lakeview cemetery to Wilson avenue and return. The trial trip was accomplished in 40 minutes for the run of six miles, which was a saving in time over horse cars of 20 minutes, or one-third for each trip. From that small beginning in one short year the electric system has grown to proportions of great magnitude. The East Cleveland company has 40 electric motors in service, all of them of twice the horse power that they originally used. The cars are running 5,000 miles per day and reducing the running time per trip at least one-fifth as compared with horse power a year ago, and affording 33 per cent. more seating room than at that time. The company has erected wires over 32 miles of track, and would ere this have had all the wires in service had it been possible to secure the necessary motors. Notwithstanding the popular impression as to the dangers of electrical transit, the operation of the cars for the past year has tended to prove their greater safety in comparison with horse-car service, a less number of persons having been injured by being run over than during the previous year, when operating by horse power.

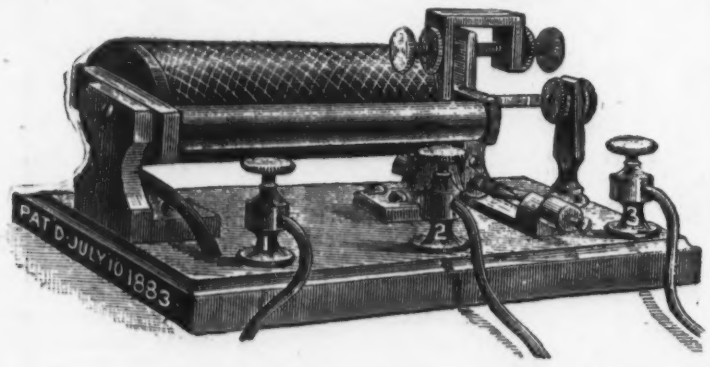
The Brooklyn company has wired 24 miles of track and is operating 30 motor cars, running over 3,000 miles daily, at an average saving per trip of fully 20 per cent. The Broadway line has wired 12 miles of track, and of their 16 motor equipments ordered has in daily operation eight motors, running 1,000 miles per day, and also saving at least 20 per cent. in time over horses, besides doubling their carrying capacity.

### London Electric Lighting Inspectors.

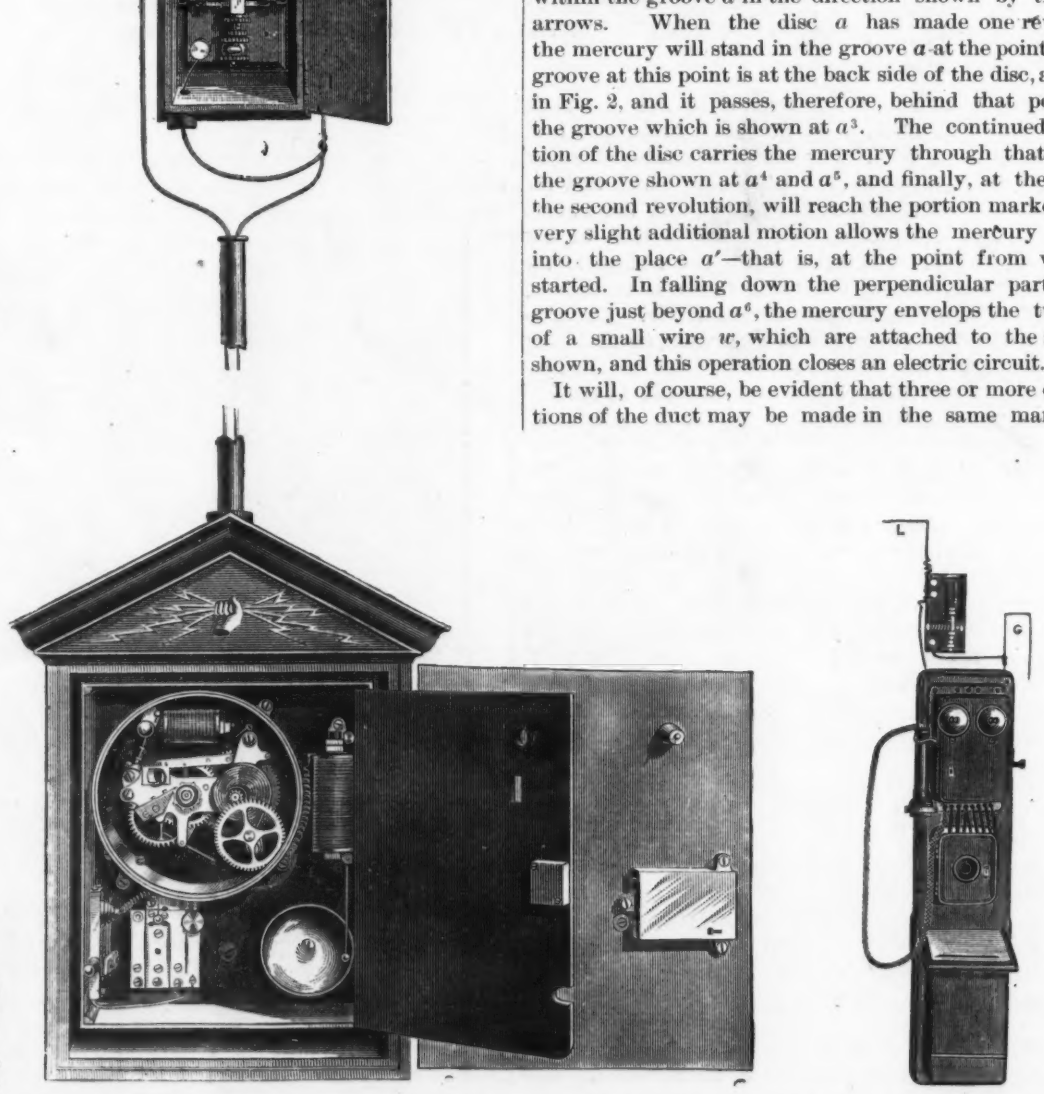
It appears that three persons are to be appointed by the London County Council to watch over the electric lighting enterprises of London—a competent inspector at £200 a year to test meters and to discharge the duties under the Electric Lighting act; a caretaker at £2 a week to attend to the instruments and accumulators, and a supervisor at £3 3s. a week to supervise the work of the electric lighting companies in the public streets, and to see that the requirements of the council are complied with. The salary for inspector at £200 a year does not seem excessive when it is considered that the person appointed will fill a very responsible position, and must be a thoroughly competent electrical engineer, with practical and testing experience. The charge for testing meters can be charged for at the Council's own rates. It is understood that the Board of Trade would appoint officers in the absence of the council so doing, and have power to charge the salaries upon the rates.

### The National Electric Protector.

Where telegraph, telephone and other wires designed to carry only light currents are run in proximity to wires carrying heavy currents, some device is necessary to protect the instruments connected to the former from the effects of a cross, which would ordinarily result in a "burn-out." We have recently had occasion to inspect a simple instrument, designed as a safeguard, which appears well adapted for this purpose. Our engraving Fig. 1 shows it in perspective, and, as will be seen, it consists of a magnet core, one leg of which is surrounded by a coil, the other being free. Opposite the two poles of the electromagnet is an armature which is normally withdrawn by a spring against an insulated back stop in the upper cross-piece. The metallic part of the cross-piece is connected with the binding post marked 3. The binding posts 1 and 2 are the terminals of the coil of the electromagnet. The circuit coming in from the line is connected to binding post 1, passes through the coil and out at binding post 2, and then to the instrument to be protected.



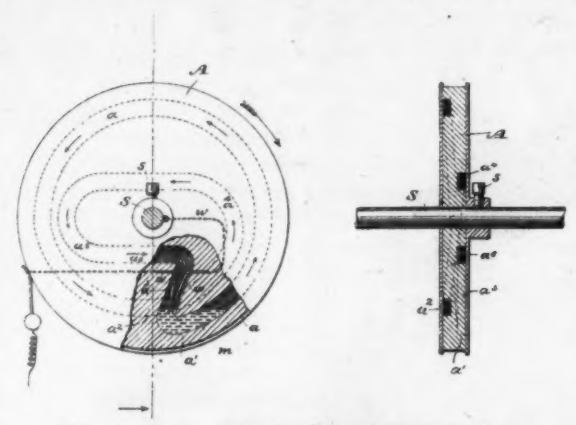

As long as the current is of normal strength the magnet remains without sufficient energy to attract its armature; but as soon as an abnormal current comes over the line the armature is attracted and closes its front contact, the result of which is that the larger part of the current is shunted around the instrument to be protected. The shunt current passes out through binding post 3 to ground. The instrument is very small and the manner of its application for the protection of the telephone is shown in Fig. 2. As the resistance of the coil is very low, being only .041 ohm, its insertion in the circuit has no detrimental effect. For the protection of fire-alarm boxes, the arrangement is such that, instead of the surplus current being shunted to ground, it is shunted along the line, and hence leaves the system still operative. This arrangement is shown in Fig. 3. We have had occasion to witness the operation of the instrument, and judge it to be well able to protect instruments of this class from burn-outs. The protector has been in use for some time on various fire-alarm and police telegraph circuits, and on a considerable number of telephones in this city and elsewhere, and seems to answer its purpose, as witnessed by a large number of testimonials. It is manufactured by the National Electric Protector Company, of this city.




FIGS. 1, 2, 3 AND 4.—THE NATIONAL ELECTRIC PROTECTOR AS A SAFEGUARD FOR ELECTRICAL APPARATUS.

### Irrational Popular Clamor against High Tension.

However desirable the underground system may be, says the *Engineering and Mining Journal*, there is no doubt as to the irrationality of the popular clamor. Simply putting the lines underground does not eliminate the danger. Not only do the wires have to come out of their conduits to the lamps, but several new possibilities of danger exists in the subways themselves.




FIGS. 1 AND 2.—THE PRENTISS ELECTRIC CAM.

Will the arc light and the power wires have to go? By no means. It is possible now to obtain insulation which will resist moisture and certain kinds of chemical reagents, as is shown every day in the long submarine cables. Some lucky inventor, or more probably some systematic experimenter, will soon come forward with a reasonably cheap and durable insulating covering which shall be reliable. We have already described the London system; what is needed for general application is something equally good, but cheaper.

Electricity of high tension in large currents is bound to be used in the future. There will always be *some* accidents, as in the use of all high powers and machinery. Yet no one thinks of discarding steam for that reason; the result is, improvement of the boilers and connections. Such will be the history of electricity. The aim will be to reduce the risks to the minimum, for absolute impunity is not to be hoped for.

### The Prentiss Electric Cam.

Among the ingenious electric devices recently patented is one the object of which is to close an electric circuit but once in two revolutions of the shaft upon which the device is fixed. Such a cam can be used in a number of situations, but was specially designed for use in connection with a clock where some device, as a calendar, is desired to be set in operation once in twenty-four hours, and this device saves the necessity of adding a twenty-four-hour wheel to the clock.

The accompanying illustrations show the cam in elevation and section as attached to a shaft. Within the disc $A$ is a continuous groove $a$, having its lowest portion at $a'$. This groove contains a small portion of mercury $m$. In the position shown in Fig. 1 the device has just operated or performed the function required, and is ready to be carried forward for another operation. The groove $a$ can be traced by the dotted lines in Fig. 1 throughout two complete turns or revolutions within the disc. If we suppose the shaft $S$ is turning so as to carry the disc in the direction indicated by the arrow, it is evident that the mercury $m$ will be carried within the groove $a$ in the direction shown by the small arrows. When the disc $a$ has made one revolution, the mercury will stand in the groove $a$ at the point $a^2$. The groove at this point is at the back side of the disc, as shown in Fig. 2, and it passes, therefore, behind that portion of the groove which is shown at $a^3$. The continued revolution of the disc carries the mercury through that part of the groove shown at $a^4$ and $a^5$, and finally, at the end of the second revolution, will reach the portion marked $a^6$. A very slight additional motion allows the mercury to drop into the place $a'$—that is, at the point from which it started. In falling down the perpendicular part of the groove just beyond $a^6$, the mercury envelops the two ends of a small wire $w$, which are attached to the shaft, as shown, and this operation closes an electric circuit.

It will, of course, be evident that three or more convolutions of the duct may be made in the same manner, in which case the operation of the device takes place but once in the number of turns of the shaft corresponding to the number of such convolutions.

**"La Naturaliza"** is the name of a new paper to be published at Madrid by Fuentes Y. Capdeville. Its programme includes electricity.

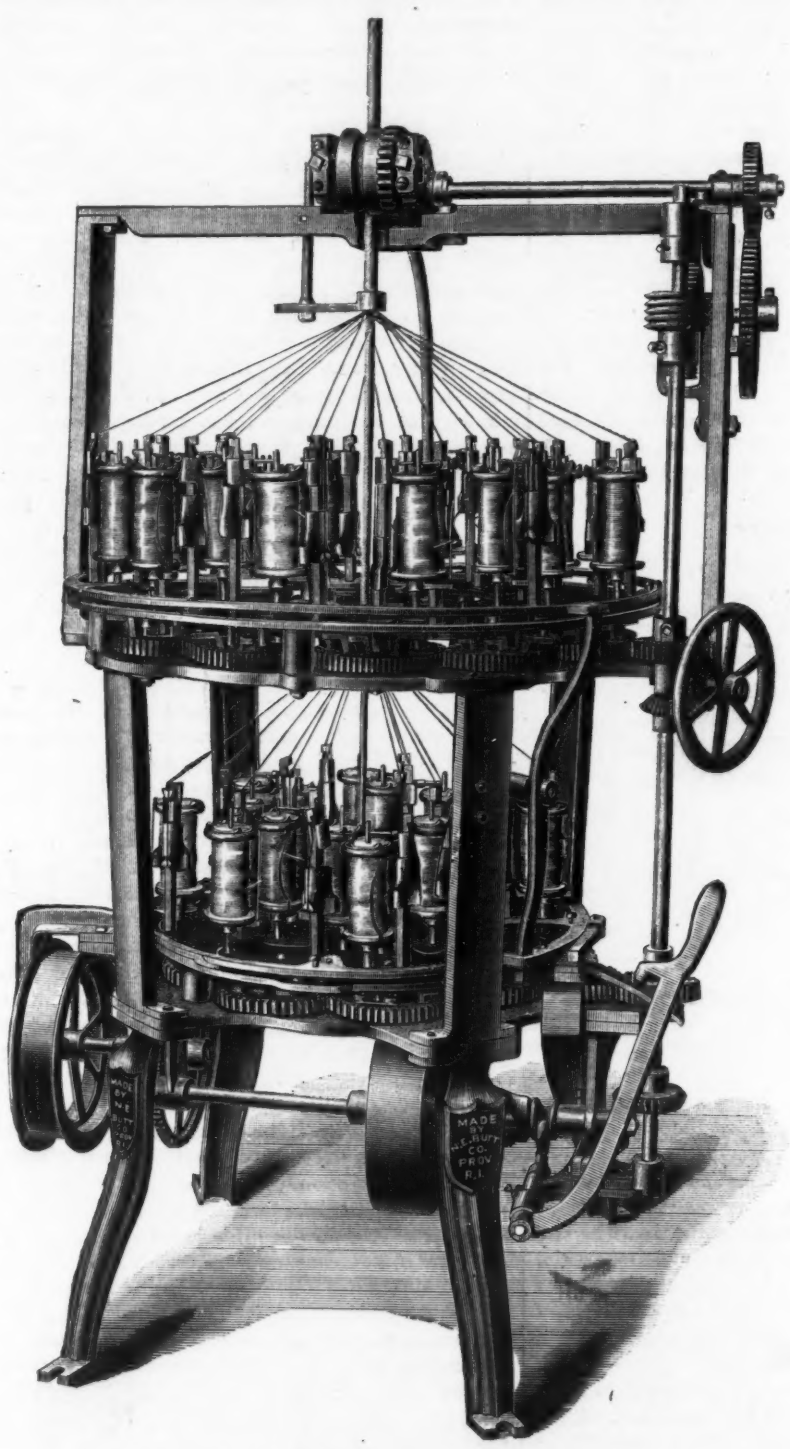
**The Electric Sugar Frauds.**—The untried parties to the notorious conspiracy in the case of the "Electric Sugar frauds" are soon to be put on trial. Recorder Smyth having denied the recommendation of District Attorney Fellows for the suspension of judgment in the cases of Olive E. Friend, Emily Howard, George Halstead and Orrin A. Halstead, co-defendants with William E. Howard, who, on June 18, 1889, was convicted of grand larceny and sentenced to nine years in the penitentiary. All of these respondents last week withdrew their plea of guilty and pleaded not guilty. The date of the trial is not yet determined.

### New Heavy Double Braiding Machine.

The greater power and covering capacity required by the increased size of wires and cables has necessitated the construction of more powerful and stronger machinery than has heretofore been employed. In order to meet this demand the New England Butt Company, of Providence, R. I., have recently brought out the new double 16 × 24 braiding machine shown in the accompanying illustration.

This machine carries a large bobbin, having a 4½-inch traverse with a 3-inch head, with weights varying from 3 to 20 ounces, thus allowing the use of a coarse covering material.

A new principle of driving the take-off reel is adopted in this machine, power being taken direct from the driving shaft and thus relieving the feeding mechanism from the great strain of turning the heavy coil of wire or cable. All the parts are built strongly and substantially with a view to meeting the requirements of this class of work.




NEW HEAVY DOUBLE BRAIDING MACHINE.

### The Sperry Work in Electric Mining.

The Sperry Electric Mining Machine Company report that rapid progress has been made toward perfecting and completing their entire system of electric mining machinery.

Illinois has, it is claimed, three times the coal area of any other State of the Union. The recent published report of the secretary of the State Board of Labor Statistics shows the number of tons of coal produced by mining machines the past year to be greater than ever before, and speaks specially of the interest in, and work done, by electric machines. The demand for coal-cutting machinery for use within short distances of Chicago, and the urgency of the purchasers, have kept the company confined to the production of this branch almost to the exclusion of their drilling machinery and other portions of their system. The coal mining machines, already illustrated in THE ELECTRICAL WORLD, have been in constant and successful use for several months past, and the demand at present largely exceeds the output. Among the latest improvements in the system may be mentioned the method of regulation and distribution, the details of which have been carefully worked out, double pole test fuses being used at the junctions of the "butt entries." These are provided with hoods for prevention from incidental contact and also for protection against moisture. A portable reel is used provided with sufficient flexible wire to extend the circuit connections from the main wires in the entries the entire depth of the rooms in which the machines operate. These reels not only prevent the destruction of the wire, and afford an excellent means for its removal from place to place, but within the body of the reel is a regulator for the purpose of controlling the rapidity of operation of the machine, so that once started on the number of blows per minute giving best results in that particular seam of coal, that number is absolutely maintained hour in and hour out. The reel rests upon a tripod provided with handles.

The machines have been decidedly improved, having received their "refinements" by being made coarser and more solid, *i. e.*, by this process of rendering it more substantial, the machine has reached the present high standard of perfection. The character of the "runners" handling these machines and the surroundings are the farthest removed from those ordinarily met with in connection with electrical machinery, and when these are considered it will be readily understood that success lies entirely in simplicity; few and almost clumsy working parts so arranged that they will absolutely care for themselves under all circumstances. The number of working parts have been reduced forty per cent. from the first machine built.

As the crucial test of continuous commercial operation progresses, advantages which at first were fancied to be great have given place to those of real sterling value. It is now found that the principal among these are the "freedom from kick" or recoil upon the operator. When a succession of heavy concussive blows is delivered by the ordinary types of machines, the recoil is so serious as to prohibit their use in some districts. The great success of percussion drills generally is conclusive as to the value of the method adopted in this machine for doing the work; the principle of the oldest successful instrument, the *pick*, being thus employed. The peculiar non-synchronous action between the crank and motor is the distinctive feature of the Sperry machine. Its operation confines the strain within the machine itself at the instant succeeding the delivery of the blow, leaving no time for the pushing action of the machine back upon the "runner." This recoil not only disables him, but throws the machine out of range and prevents the proper direction of the successive blows. The instantaneous commencement of the *mouvement de retracte* of the projectile, as one foreign contemporary characterizes it, has gained much applause for the inventor from engineers both here and abroad.

Another advantage developed is the economy in installation. For instance, only about one-fourth of the boiler capacity is necessary, as compared with a compressed air installation for the performance of the same work, with the decided advantage in favor of electricity that the plant can be installed in a very short time there being no trouble with innumerable joints, which are liable to leak. The rapid advance of the use of electricity as power in mining operations throughout this country as well as abroad has given facilities for the gathering of data which is very useful in discovering the exact value of electrical methods as compared with compressed air. These show an economy of operation in favor of electricity of not less than 70 per cent. for the same work at the face in the mine.

### Special Train for the February Convention.

The New York Committee on Transportation, appointed by President Weeks to make arrangements for the delegates desiring to attend the National Electric Light Convention at Kansas City, held a meeting at the Electric Club on Friday evening, Dec. 27. It is proposed to run a magnificent special vestibuled train through from New York City to Kansas City without change via the Pennsylvania Railroad to Chicago and via the Chicago, Burlington & Quincy Railroad from Chicago to Kansas City. Full particulars and information will be supplied in circular form in a few days.

### Kansas City Preparations for the Convention.

At the last meeting of the reception committee of the National Electric Light Association sub-committees were appointed as follows to make preliminary arrangements for the sixth annual convention of the association, which will be held in Kansas City the second week in February, at the Coates Opera House, beginning Tuesday, the 11th, and continuing four days.

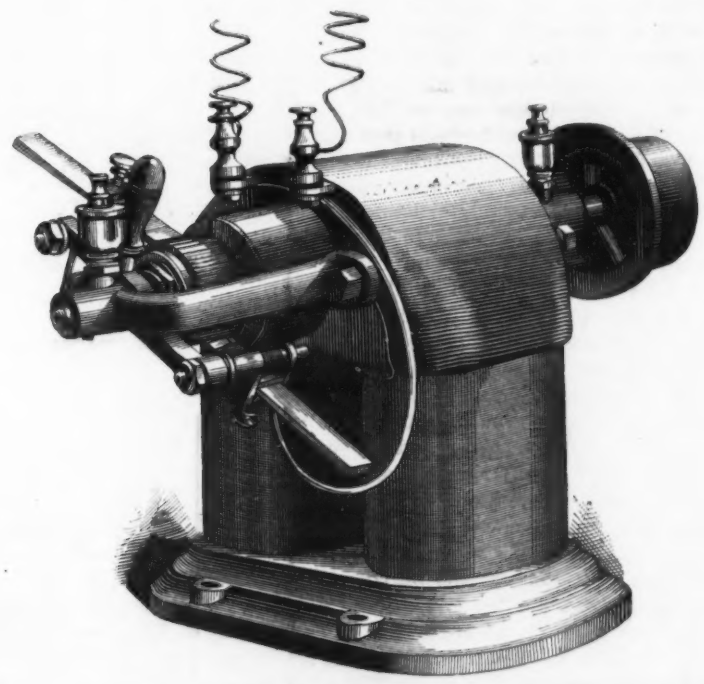
The exhibits of electrical apparatus and supplies will be made in Casino Hall on Broadway, which has a floor area of 6,000 square feet. This space is nearly all spoken for already. All exhibitors will ship their goods consigned to themselves care of the Kansas City Transfer Company, Kansas City, Mo. This company agrees to take charge of all packages thus marked and convey them promptly to Casino Hall

Mayor Davenport will welcome the association and attending visitors from the stage of the Coates Opera House at the opening session, Tuesday morning, Feb. 11. President E. R. Weeks will open the convention with a brief address.

Finance Committee—C. A. Ross, Edward La Salle, George M. Meyers, of Kansas City; A. H. Reese, D. R. Russell, St. Louis.

Entertainment Committee—C. S. Rusling, F. S. Caldwell, Edward La Salle, Ira C. Hubbell, O. H. Schramm, J. W. Mason, M. E. Bates, F. K. Holtzinger, W. W. Smith, M. D. Wood, H. C. Sprague, George M. Meyers, Kansas City; L. H. Atterbury, St. Louis.

Printing Committee—H. C. Sprague, W. W. Smith, Ira C. Hubbell, Kansas City.



THE "AURORA" DYNAMO AND MOTOR.

### The "Aurora" Dynamo and Motor.

The accompanying engraving represents the new dynamo and motor, the construction of which has recently been begun by the Aurora Electric Company, of Philadelphia. Special pains have been taken to make the machine strong in all its parts. To effect this, the field magnets and base of the machine consist of but two pieces, so that only one joint is made in putting the machine together. The armature is of the drum type, and runs on long, hard bronze bearings. The machine illustrated is of 15 lights capacity. The company makes a specialty of experimental electric machinery of all kinds.

## The Thomson-Houston Mining Locomotive at the Erie Colliery.

We present on this page a view of the electric locomotive recently introduced by the Thomson-Houston Electric Company in connection with its mining work, and of which one has been installed at the Erie colliery, near Scranton, Pa., as noted in these columns not long ago. With regard to the operation of the plant we cannot do better than borrow from the description of the *Colliery Engineer*, which sent a representative to the mine to watch its operation. We abstract his account as follows:

The engine running the dynamo is an Armington & Sims standard engine, double disc, with two wheels. The dimensions of this engine are as follows: Cylinder, 9½ inches in diameter; stroke, 12 inches; speed, 278 revolutions per minute; steam pipe, 3½ inches in diameter; exhaust pipe, 4 inches in diameter. The two wheels are each 5 feet in diameter, by 10½ inches face. Supplied with steam at an initial pressure of 70 pounds, the engine develops 41.5 indicated horse power. The dynamo is a 50 h. p. Thomson-Houston H. I. (spherical armature) machine. The voltage at terminals, 220. Pulley, 15 inches diameter; speed, 1,150 revolutions per minute. The engine and dynamo are in the hoisting-engine room at top of shaft, and they are in charge of an engineer and assistant, who also have charge of the hoisting engines, a "geared-down crank-pump," and the breaker engine, all of which are in the same engine-room.

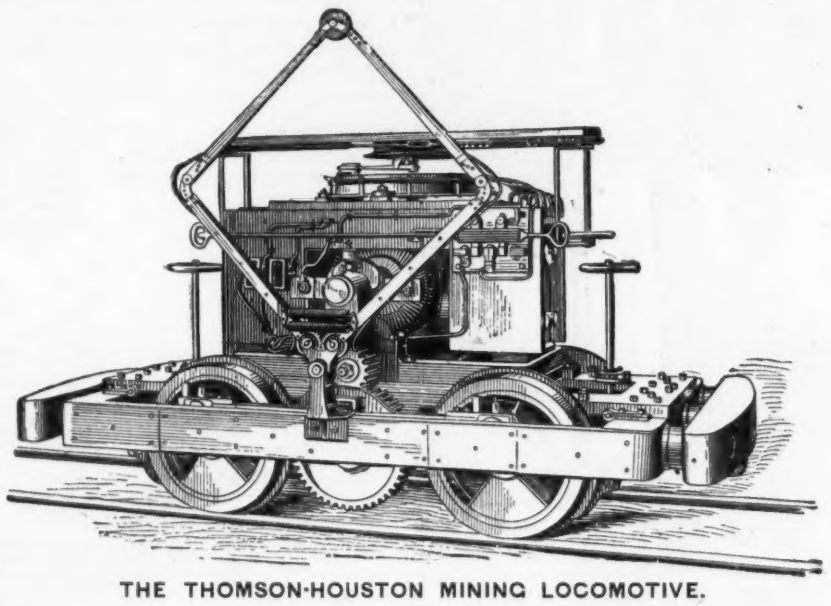
The current is carried from the dynamo to the head of the shaft and down the shaft inside a line of 1½-inch gas pipe, by a No. 0 Clark copper wire (.34 inches diameter). From the dynamo to the foot of the shaft the line is 260 feet long. In the engine house near the dynamo are an ammeter, a voltmeter and an automatic cut-out. This latter acts whenever a short circuit is established, or when any similar accident should occur at any point on the line. This cut-out is quicker in its action than the ordinary fuses, and is put in for the extra protection of the generator.

After reaching the bottom of the shaft, the wires are conveyed overhead, at a distance of 12 inches outside of the low or south rail of each track. They are suspended from the roof by specially-constructed mine insulators and hangers. A brief description of the methods of securing these hangers to the roof is as follows: A hole is drilled in the top rock, and a bolt with the upper end made wedge-shape, and larger than the diameter of the stem, is placed in the hole. Then a short piece of gas pipe, split at one end, and of less diameter than the upper end of the bolt, is placed in the hole and encircles the stem of the bolt. Then a piece of 4 × 3-inch timber, with a hole bored through it just large enough to accommodate the bolt, is placed against the top, and the nut end of the bolt projects below the block. By screwing on the nut with a wrench, the bolt is drawn down into the split gas pipe, and by spreading it apart it binds itself firmly in the solid rock. This arrangement is made at each end of the block, and the insulated hanger is screwed into it, midway between the two bolts. The method thus followed is very simple yet very effective, and answers the purpose. Where two lines of wire join they are connected with a frog, which is the same as used in all Thomson-Houston under-running trolley work in street railway practice. Once set in position, it needs no attention. The conducting wires are soldered to the insulated hangers at necessary intervals, and all the ends of the wires are anchored so as to take the longitudinal strain off the hangers.

The current is tapped from the main conductor where necessary and passed through a fuse-box, and then through two 110-volt, 16 c. p. incandescent lamps, the wire then being grounded at the rail for return. There are 50 lamps in use, eight of which are in a row on each side of the foot of the shaft. There are two lamps in the pump-room, four in the underground blacksmith shop (three of which are fixed and one portable), two in the slope-engine room, and the rest are distributed along the gangways, except two portable lamps, which are attached to the locomotive.

The roadways were only changed so as to accommodate an increased output. The shaft sidings now have a capacity for 70 loaded wagons and 50 empties. From the sidings the loaded wagons run to the shaft by gravity. The rails are made continuous for the metallic circuit by drilling a hole in the web at each end of each rail, and a copper wire loop is riveted in these holes so that there is a continuous line of metallic conductor past each rail joint. The track at the foot of the rock plane is of 36-inch gauge. All the rest of the tracks are double gauge, or three-rail tracks, the gauges being 36 and 28 inches. These roads accommodate the slope wagons, which are all of the narrower gauge.

The motor used on the locomotive is the regular Thomson-Houston railway motor, type "G," nominally 40 h. p., built after designs and inventions of Mr. C. J. Van Depoele. The motor is placed on top of the truck. On top of the machine is placed a rheostat controlled by the hand wheels shown at each end. This rheostat regulates the flow of the current to the motor, so that the man in charge has full control of the speed and power of the machine. In this instance the rheostat is on the top of the machine, and adds 14 inches to its height. As it can be more conveniently placed on one end, and thus reduce the height of the machine 14 inches, future locomotives will be so made. On the side of the motor there is a reversing switch of the regular railway type, with handles at each end of the locomotive. A novel trolley arrangement is used, which does not need any attention when the machine is reversed. The trolley arm accommodates itself to the varying heights of the wire, and allows for a difference in the height of the wire of 3 feet 6 inches, and is so arranged that, if by any accident it should strike an obstruction, it falls flat along the side of the locomotive without any damage being done. The trolley wheel is of brass, and from it the current is conveyed by two wires to fuse boxes, thence through the rheostat to the fields, and thence to the reversing switch. The running gear was built at the Dickson Manufacturing Company's locomotive works at Scranton. The wheels, of which there are four, are the Dickson Company's standard 24½-inch steel locomotive wheels. The wheel base is 4 feet. The wheels are driven by connecting rods attached to cog wheels, which in turn are driven by pinions on intermediate shafts, geared direct to the armature spindle on the opposite side to that shown in the cut. The connecting rods are lubricated with the Lackawanna lubricating compound, which is fed to the bearings by one-ounce Lackawanna grease-cups. The brake is a lever brake and is controlled by hand wheels and foot ratchets shown in cut. Everything is so arranged that the motor man can run the machine from either end, and the hand wheel controling the rheostat, the reversing lever, and the brake wheel are so located that he can easily reach them without moving from his seat. He thus has complete control of the machine and can handle it with great ease and convenience. It is built to run on the 36-inch gauge, and is of the following dimensions in the clear: Length, 9 feet 7 inches; width, 5 feet 4 inches; height, 5 feet 6 inches. It weighs 10,500 pounds, and to this has been added 1,800 pounds to increase its traction.



THE THOMSON-HOUSTON MINING LOCOMOTIVE.

The locomotive is run by one man, who is assisted by a boy to help make up the train and turn switches. It displaces seven mules and three drivers. This is a small margin on which to base any marked saving, but it must be remembered that in this instance the main object was to increase the output without increasing the expense. The mules were taken off the road on Tuesday morning, the 8th ult., and since that time the colliery has worked, owing to lack of railroad cars and other similar causes, but 11½ days. In that time the average number of loaded cars delivered at the shaft bottom by the locomotive was 559.5 per day. The average number delivered by mule-haulage from the first of the year till the locomotive was put in was 526.95 per day. And in this connection it is but fair to state that the locomotive frequently had to wait at the bottom of the shaft for empty cars.

So far the locomotive has fully shown that it can hold the following schedule, which will increase the average output to at least 700 cars per day, and it is proposed to prove this in the course of the coming month:

EAST OR SLOPE SIDE.

| | |
|---|---|
| Distance run per trip, including making up, etc. | 2,884 feet. |
| Time of trip | 10½ min. |
| Cars per trip | 15 |
| Trips per day | 16 |
| Miles run per day | 8.73 |
| Total time | 2 hrs. 40 min. |

Locomotive reversed 128 times per day.

WEST OR PLANE SIDE.

| | |
|---|---|
| Distance run per trip, including making up, etc. | 2,546 feet. |
| Time of trip | 6¼ min. |
| Cars per trip | 20 |
| Trips per day | 26 |
| Miles run per day | 12.55 |
| Total time | 2 hrs. 50 min. |

Locomotive reversed 104 times per day.

The above schedules, that are certainly within the power of the locomotive, will deliver 760 cars per day. As it will not always be possible to get a full trip each time, 700 cars can be calculated on as near the actual number available. Then from the above schedules we may deduce the following: To deliver 700 cars per day of ten hours, the time of running of the locomotive will be five hours and thirty minutes, leaving four hours and thirty minutes for contingencies. The total distance run will be 21.28 miles, and the locomotive will be reversed 232 times.

## The Methods of the King of Dahomey.

The newspapers of New York City have begun to change their tone with regard to electricity and electric lighting, and, now that their scare or stampede is over, are beginning to talk sense again. The *Evening Post* says:

"The way in which the city is being relieved of its electric lights is in all respects worthy of the way in which they were supplied. It is in all respects suitable that a new system of municipal lighting, created under the superintendence of a butcher, a theatrical ticket agent, and a saucy young lawyer, should be got rid of by cutting down the poles with an axe and plunging the town in darkness. This is the way the King of Dahomey would deal with the problem, and we have in the government of this city been in many ways close imitators of that monarch's methods. We may feel sure, however, that no great city which has once been lighted by electricity will go back permanently to gas. We shall have electric lights in New York again, but we shall get them in civilized fashion. They ought to have been supplied in the beginning under rules carefully drawn by a board of electrical experts, prescribing the size and nature of the wires, the intensity of the currents, the mode of transmission to houses and street lamps, so as to secure the maximum of light with a minimum of danger and inconvenience. What we want now is the abolition of the present board by an act of the legislature, and the creation of a new one composed of competent electricians. In other words, we must begin all over again. No company will, of course, embark in the business of supplying electric lights which is liable to have its errors or shortcomings remedied by the wholesale destruction of its property by bands of laborers armed with hatchets. We must have the whole matter put under a carefully prepared law, with its execution committed to competent hands."

The New York *Sun* remarks:

"The interruption of the electric lighting in so large a part of the town has served as a practical demonstration that the new method of illumination has become a necessity to the community. When the people had the electric lights in the streets they did not appreciate the vast superiority to the old gas lamps, which they had gradually replaced. But now that they are gone and we are forced to rely on gas alone, everybody discovers how much was gained when modern invention utilized electricity for illuminating purposes. Undoubtedly the precise manner in which the electricity was made available was bad and dangerous. The new agent was introduced as an experiment and in a haphazard way by different companies employing different systems; but as its advantages were proved and its use extended, the public were warned by many shocking accidents that the whole business must be begun over again, so that better illumination should not be secured at the peril of men's lives. Well-lighted streets at night are a great protection to life and property. They are a requirement of modern civilization. But if the danger from the electric wires is greater than the danger from incendiaries, burglars, and highwaymen, as proved to be the case under the existing method of conducting the electric current, the price paid for the superior light is too heavy. People would rather stumble through dimly but safely lighted streets than make their way at night under an illumination like that of midday, but which exposes them to the peril of sudden death if they happen to touch the wrong wire. Mayor Grant, therefore, was justified in requiring that first of all the safety of the public should be considered, though he might have prevented the relative darkness in which the town is now at night by making better preparations in advance of his assault on the wires.

"But the interruption of this now necessary illumination will be temporary only. We must have the electric light. We cannot get along without it. It has become essential to business, which has been regulated with reference to it, and civilization in a great town would suffer a set-back were we deprived of it. The only thing to do is to reduce to more scientific order the careless and experimental methods of its first introduction. There is no doubt that electric lighting can be made safe, so far at least as ordinary contingencies go, and that its vast superiority to every other for public and very many private purposes justifies any cost which such safety will render necessary. It is a problem for expert electricians to solve, and which they are capable of solving. A private individual would have no doubt as to where to go to get the matter settled, and the authorities have no reason for hesitation as to their manner of procedure. The

treatment of electricity has become one of the recognized professions, and, though so much is yet to be learned as to the agent, enough is already known to make entirely possible a sufficient remedy of the great evils due to the make-shift arrangements for the original introduction of the electric light.

"The period of deprivation, therefore, will be short, and when the light is again made available for safe use in all parts of the town the demand for it will be greater than before, and the cost of the improvements will be recompensed. The companies can afford to incur the additional expense, now that it has been practically demonstrated that they provide the community with what is indispensable to modern life."

### Loss of Power by Radiation of Heat.

At a meeting of the Boston Electric Club last week, Mr. John C. Wilson in the chair, Mr. F. C. Childs, of the firm of Nightingale & Childs, read a paper on the "Loss of Power by Radiation of Heat," of which the following is an abstract:

To him who holds the purse and pays for the coal consumed, it is of importance that between the energy of the burning fuel and the power developed by the engine there should be the least possible loss. Every unit of heat radiated by boiler pipe, cylinder or heater is absolute loss, and must come out of that purse. In an electrical plant this matter is of great importance. There is less opportunity to have results obscured. These is, proportionally, a large possible loss between the coal on the grate and the far end of the cylinder, and this loss should be reduced to the minimum.

Few appreciate the great loss of heat from uncovered or imperfectly covered pipes. Many have an indistinct impression that there may possibly be some slight loss. But there is in many cases an absence of knowledge upon this subject where it should be complete. The most correct data available show that the radiation from uncovered 2-inch steam pipe, with 60 pounds steam pressure, is 391.83 kilo. centigrade heat units 1 foot 1 hour, or 21,739.78 kilos. of coal for 100 feet per year of 300 days of 10 hours each; 1 kilo equals 2.205 pounds. Properly combining these figures we see that there are 23.97 tons of coal lost by radiation from that uncovered pipe. If the coal costs $4 per ton, the radiation from this 100 feet of pipe will amount to $95.87.

Recently I have seen in the *American Engineer*, of June 12, a report of the proceedings of the Michigan Engineering Society, containing a paper by Professor Cooley, of Ann Arbor, Mich., in which he says: "The benefits of covering steam pipes to prevent radiation are strikingly illustrated by the following example: The Thomson-Houston electric light plant in Ann Arbor has about 60 feet of 7-inch pipe connecting the boilers with the engines and two large steam drums above the boilers. In March, 1887, the steam at the far end of this pipe was tested to determine the amount of entrained water, the pipes and drums at the time being uncovered. An average of nine experiments gave 31.01 per cent. moisture. In June of the same year, after the pipes were covered with magnesia sectional coverings, the quality of the steam was again tested, the average of five experiments giving 3.61 per cent. moisture; the tests were made by the same men from the same connections, and in the same manner."

It is found in practical operation that the covering of the steam cylinders of engines with the Magnesia covering, by reducing the condensation within the cylinder materially, increases the duty performed, so much so that many of the most successful builders of engines, where obliged by their contracts to produce the maximum duty per pound of coal, always use this magnesia.

The paper was listened to with the utmost interest, and Mr. Childs, in answer to a question from the chairman, stated that his material was composed of carbonate of magnesia, with a small percentage of asbestos fibre. The material was shaped in moulds and then dried for about three weeks, after which it was finished by machinery. Mr. Alex. P. Wright stated that at the outstart he had not fully appreciated how closely allied the subject under discussion was to electric lighting interests. The whole thing resolved itself into a question of insulation to prevent loss from the boiler to the lamp. We should not assume that electricians are going to save all the losses, but we should start by saving money in the very shovel.

Mr. Wilson made a few remarks, drawing attention to the series of experiments made by Hertz in Germany, and the analogy between heat, light and electric vibration.

Mr. Gerald made a few remarks, showing why there was a necessity for steam separators in addition to steam pipe coverings, owing to boiler priming. Some engines also had the strange tendency to draw the water from the boiler into the cylinders.

Mr. Wright then stated that electricians were not saving as much electrically as Mr. Childs claimed to save on the steam pipes, and suggested that a paper be read at the club on the subject of insulation in its true sense, as a method of preventing loss in the boilers, piping, engines, dynamos, wiring and lamps.

Mr. W. H. Cunningham, of the Boston Manufacturers' Mutual Insurance Association, was present, and expressed himself as very much pleased to have the opportunity of hearing such a subject discussed, and hoped to have the privilege of attending at future meetings.

### The Connecticut Electric Light Association.

A meeting of representatives of central station electric light companies doing business in the State of Connecticut was held at New Haven, December 23. Eleven Companies were represented in person and a number of others by letter, expressing their sympathy with the movement and explaining their inability to be represented on the present occasion. A majority of the companies of the State reported and much more than a majority of the capitalization in the State was represented in person, and it was therefore resolved to effect an organization at once.

Pursuant to this resolve, a constitution was adopted and the following officers were elected: James English, president; J. A. Hadley, first vice-president; J. P. Stowe, second vice-president; John C. English, treasurer; A. M. Young, secretary. *Executive Committee*—James English, New Haven; J. A. Hadley, Meriden; J. A. Stowe, Middletown; John C. English, Bridgeport; A. M. Young, Waterbury; L. S. Beardsley, Naugatuck; F. F. Fusenich, Torrington.

### New Pocket Magneto Testing Bell.

Among the novelties recently brought out by the Viaduct Manufacturing Company, of Baltimore, is a pocket magneto bell, designed for inspectors' and linemen's use. The instrument is a powerful little magneto generator, capable of ringing through 10,000 ohms resistance, and is put up in a round nickel-plated case or tube, with a removable top that unscrews, allowing the bells to be exposed when necessary. The binding-posts for the wire and telephone connections are on top.

Instead of employing a crank, as heretofore, for turning the magneto armature, a button is provided, which projects from the side of the case, and which, when pressed, revolves the armature and generates the required current. This button can be removed when the bell is carried in the pocket.

We have already described in these columns a new magneto fire alarm system of the Viaduct Company. This has recently been installed at Dansville, N. J., where seven street boxes are connected with two hook and ladder houses. The system has met with general satisfaction, as vividly portrayed in the notice of it in the local newspaper.

The company has also undertaken the manufacture of a magneto bell that rings by a simple pull down, no crank being used. It is designed especially to avoid the use of batteries, push buttons, etc.

### The Gresham* Decision on Double-Carbon Arc Lamps.

IN THE CIRCUIT COURT OF THE UNITED STATES FOR THE DISTRICT OF INDIANA.

*The Brush Electric Company vs. The Fort Wayne Electric Light Company, et al. No. 8,250. Chancery.*

GRESHAM, J.:

This suit is brought for an alleged infringement of Letters Patent No. 219,208, granted to Charles F. Brush, Sept. 2, 1879, for improvement in double-carbon electric lamps of the arc type. Brush assigned the patent to complainant before suit was brought.

When two ordinary, pointed carbon sticks are in contact in an electric current the circuit is closed, and the current freely passes through the carbons without the production of any appreciable amount of heat or light at the point of contact. If, however, while the electric current is passing through them, the carbons are slightly separated, the current will continue to flow in crossing or leaping the small space between the separated carbon points, and intense heat and light will be produced. This is known as the electric arc lamp, and the one generally used for illuminating large buildings and halls, and for lighting streets. The incandescent electric light is produced by causing a current of electricity to pass through a filament in a glass bulb from which the air has been exhausted. In its passage the current encounters great resistance and as a consequence it is heated to a degree producing a bright, white light throughout its entire length. This light is well adapted to use indoors.

As early as 1810 Sir Humphrey Davy, with a battery of 2,000 cells, succeeded in producing an arc light between two horizontal charcoal pencils, insulated, except a small portion at their ends, but owing to the rapid combustion of the soft charcoal points and the great cost of the battery, and the short duration of the light, it was of no practical or commercial value. But little progress was made in the improvement of this arc light or lamp until 1844, when Foucault substituted pencils made of a hard gas carbon for the charcoal pencils of Davy, and thereby for the first time produced a persistent, but short lived, electric arc light. By a clockwork mechanism Foucault fed the carbon pencils toward each other so as to imperfectly regulate their burning away and maintain the arc. The voltaic battery did not generate electricity on a sufficiently large scale, the light was expensive, and it did not go into general use.

Later the dynamo electric machine was developed in which a powerful current of electricity was produced by revolving coils of wire in a field of magnetic force furnished by powerful permanent magnets, after which the arc electric light was successfully used in light houses in England, and later (1867) in France. But, up to this time, no means has been devised for producing an adequate current of electricity for illumination at a practicable cost, and it was not until the invention of the Gramme dynamo electric machine in 1872 that electricity was produced in a manner and of sufficient strength to render electric lighting practical and useful. This machine was afterward improved in details of construction. In this state of the art, Brush entered the field of invention, and on May 7, 1878, obtained Patent No. 203,412 for his arc lamp, which was superior to any lamp that had preceded it. This lamp, however, was not capable of burning continuously more than eight or ten hours, and when used for all night lighting it was necessary to extinguish the light and renew the carbons; and in order to obviate this defect Brush invented the lamp in suit. The invention and the means by which it is carried out are thus described in this specification.

"My invention relates to electric lamps or light regulators, and it consists, first, in a lamp having two or more sets of carbons adapted, by any suitable means, to burn successively—that is, one set after another; second, in a lamp having two or more sets of carbons, each set adapted to move independently in burning and feeding; third, in a lamp having two or more sets of carbons adapted each to have independent movements, and each operated and influenced by the same electric current; fourth, in a lamp having two or more sets of carbons, said carbons by any suitable means being adapted to be separated dissimultaneously, whereby the voltaic arc between but a single set of carbons is produced; fifth, in the combination, with one of the carbons or carbon holders of a lamp employing two or more sets of carbons, as above mentioned, of a suitable collar, tube or extended support, within or upon which the carbon or carbon holder to which it is applied shall rest and be supported.

"I desire to state at the outstart that my invention is not limited in its application to any specific form of lamp. It may be used in any form of voltaic-arc light-regulator, and would need but a mere modification in mechanical form to be adaptable to an indefinite variety of the present forms of electric lamps.

"My invention comprehends broadly any lamp or light regulator where more than one set of carbons are employed wherein—say in a lamp having two sets of carbons—one set of carbons will separate before the other. For the purpose merely of showing and explaining the principles of operation and use of my invention, I shall describe it, in the form shown in the drawings as applied to an electric lamp of the general type shown in the United States Letters Patent No. 203,411, granted to me May 7, 1878, re-issued May 20, 1879, and numbered 8,718. The leading feature of this type of regulator is that the carbon holder has a rod or tube which slides through or past a friction clutch, which clutch is operated upon to grasp and move said carbon rod or holder, and thus to separate the carbons and produce the voltaic arc light; and I shall refer to such a lamp in my following description:

"*A* represents one set of carbons, *A'* another set, each carbon having an independent holder *B B'*. The carbon holders *B B'* may either be in the form of a rod or tube, and each of them is made to pass through a clamping and lifting device *C C'* respectively. These clamps and lifters *C C'*, are shown in the present instance in the shape of rings surrounding their respective carbon holders *B B'*. This form, while I have found it for general purposes the best, is not necessarily the only form of clamp that may be used in carrying out my present invention. Each ring clamp *C C'* is adapted to be lifted from a single point, thus tilting it and causing it to grasp and lift its inclosed carbon holder. This tilting and lifting movement is imparted to the clamps *C C'* by any suitable lifter *D*, and this lifter may have its movement imparted either by magnetic attraction due to the current operating the lamp, or by the expansive action of heat upon any suitable apparatus connected with the lamp, said heat generated by the electric current operating the lamp.

"I do not in any degree limit myself to any specific method or mechanism for lifting, moving or separating the carbon points or their holders, so long as the peculiar functions and results hereinafter to be specified shall be accomplished. The lifter *D'* in the present instance, is so formed that when it is raised it shall not operate upon the clamps *C C'* simultaneously, but shall lift first one and then the other (preferably the clamp *C* first and *C'* second, for reasons which shall hereinafter appear). This function or dissimultaneous action upon the carbons or their holders, whereby one set of carbons shall be separated in advance of the other, constitutes the principal and most important feature of my present invention. In the lamp shown in the drawings the lifter *D* is actuated and controlled through the agency of magnetic attraction due to the influence of the current operating the lamp, and this is accomplished as follows: One, two, or more spools or hollow helices *E* of insulated wire are placed in the circuit, within whose cavities freely move cores *E'*. The electric current passing through the helices *E*, operates to strongly draw up within their cavities their respective cores *E'*, in the same manner as specified in my former patent above referred to. The cores *E'* are rigidly attached to a common bar, $E^2$, and the upward and downward movement of this bar, due to the varying attraction of the helices *E*, is imparted by a suitable link and lever connection, $E^3$ *E* to the lifter *D*. By this connection the lifter will have an up and down movement in exact concert with the cores *E'*; and it is apparent that this connection between magnet and lifter may be indefinitely varied without any departure from my invention; and therefore, while preferring for many purposes the construction just specified, I do not propose to limit myself to its use.

"The lifter *D* may be so constructed and applied as to separate the carbons *A* and *A'* successively or dissimultaneously by being so balanced that any difference, however slight, between the weights of the carbon *A A'*, or their holders *B B'*, shall result in one being lifted and separated before the other.

"In order properly to balance the attractive force of the magnets, a coil spring *F*, or its equivalent, may be employed, substantially as shown; and to insure a steady motion to the magets and to the carbon points *A A'*, a dash pot *G*, or its equivalent, should be employed, as this prevents any too sudden, abrupt or excessive movement of parts.

"*H H'* are metallic cables, through which the current is conducted from above the clamps *C C'* to the carbons *A A'*. By this provision is not only insured a good connection between the upper carbon point and the mechanism above it, but another important advantage is obtained, and that is the prevention of sparks due to any interruption of the current between the carbon holder *BB'* and its clamp or bearings. This spark, if occurring too frequently, is liable to burn and roughen the rods *B B'* or their bearings or clamps, and thereby render their operation uncertain, because it is important that a free movement to any degree, however minute, may be allowed the carbon holder. These cables *H H'* while operating as just specified, are sufficiently flexible and yielding not to interfere with any movement of their respective carbons or carbon holders.

"The operation of my device, as thus far specified, is as follows: When the current is not passing through the lamp, the positive and negative carbons of each set *A A'* are in actual contact. When, now, a current is passed through the lamp, the magnetic attraction of the helices *E* will operate to raise the lifter *D*. This lifter, operating upon the clamps *C* and *C'*, tilts them and causes them to clamp and lift the carbon holders *B B'*, and thus separate the carbons and produce the voltaic arc light; but it will be especially noticed that the lifting and separation of these carbons is not simultaneous. One pair is separated before the other, it matters not how little nor how short a time before. This separation breaks the circuit at that point, and the entire current is now passing through the unseparated pair of carbons *A'*; and now and then the lifter, continuing to rise, separates these points, the voltaic arc will be established between them and the light thus produced.

"It will be apparent by the foregoing that it is impossible that both pairs of carbons *A A'* should burn at once, for any inequality of weight or balance between them would result in one pair being separated before the other, and the voltaic arc would appear between the last separated pair. This function, so far as I am aware, has never been accomplished by any previous invention, and by thus being able to burn independently and one at a time two or more carbons in a single lamp, it is evident that a light may be constantly maintained for a prolonged period without replacing the carbons or other manual interference. In the form of the lamp shown, I can, with twelve-inch carbons, maintain a steady and reliable light without any manual interference whatever for a period varying from fourteen to twenty hours.

"It is for some reasons desirable that one set of carbons—say the set *A A'*—should be consumed before the other set commences to burn, although it is not essential, in carrying out my invention, that the carbons should be consumed in this manner, inasmuch as, if desirable, they may be arranged to burn alternately instead of successively. It is apparent, however, if one set of carbons can be made to entirely consume before another set begins to burn, that there will be less interruption of the light than if the different pairs were allowed to consume in frequent alternation. I have therefore shown, in the present invention, one method of securing a consumption of one set of carbons before another shall begin to burn. This I accomplish through any suitable support *K*, and in such a construction of the lifter *D* that it shall be positive in its function of separating one set of carbons before the other; or in case where more than two sets of carbons are employed to separate said sets successively.

"In the lamp as shown in the drawings the support *K* is in the form of a tube surrounding the carbon holder *B*, and this support *K* is made of such a length that when the carbons *A'* shall have been sufficiently consumed a head upon the carbon holder *B* will rest upon the top or the support *K*, whereby the weight of the carbon holder *B* and its support *K* shall at all times and under any circumstances be supported by the lifter *D*.

"Besides the carbon holder *B*, with its carbon, and the support *K*, the lifter *D* (when the lamp is in operation) should also be made to carry the carbon holder *B'* and its carbon.

"The lamp is primarily adjusted so that the magnets through the lifter *D* shall always carry a definite load; to wit (in the lamp shown), the carbon holders *B* and *B'*, and support *K*. The desirability of this construction and arrangement may be explained as follows: Supposing, as is designed in the present instance, the carbons *A* are first consumed. During this time, of course, the magnets are lifting both carbon holders *B B'*. Now, when the carbons *A* are consumed, if no provision is made to the contrary, the carbon holder *B* would not be lifted during the consumption of the carbons *A'*, and this diminishment of the weight carried by the magnets would be liable to materially disturb the adjustment of the lamp and impair its operation accordingly. To obviate this difficulty I have provided the support *K*, by which provision the magnets shall be made to carry both carbon holders *BB'* and the support *K*. The difference in weight, owing to the consumption of the carbons, is a practically unimportant matter, and does not materially interfere with the operation of the lamp.

"In the case of a lamp where the carbon holders *BB'* are very light, and where the weight of one might be relieved from the magnet (or other moving agent) without material disturbance, the support *K* might be dispensed with. Said support *K* might also be omitted, if desired, in a lamp where the lifter is actuated through the agency of the expansion of the metal wire or bar by the action of heat generated by the current operating the lamp, inasmuch as the force due to said expansion being practically irresistible, it would not be so necessary to obtain a balance between various parts, as is the case with a lamp as shown in the drawings.

"Thus far I have mentioned but two ways of imparting dissimultaneous motion to the carbons of an electric lamp, viz., through magnetic attraction and through the expansive action of heat. This function of my device may be accomplished by clockwork or equivalent mechanical contrivance, and in this respect, as before stated I do limit my invention.

"*LL'* are metallic hoods or protectors for inclosing and shielding the upper projecting ends of the carbon holders *B B'*.

"In the form of lamp shown in the drawing, I obtain very satisfactory results by constructing the helices *E* according to letters patent No. 212,183, granted to me Feb. 11, 1879. In each helix *E* two independent wires surround the lifting magnets *E'*, one of fine and one of coarse wire, and each placed in the general circuit operating the lamp. These two wires (the fine and the coarse) are constructed and connected in such a manner as to carry current in opposite directions around the inclosed core, thus exerting a neutralizing influence upon each other, whereby a governing function is secured for a better description and understanding of which reference is made to said patent No. 212,183.

"The poles of the lamp shown in the drawings are constructed in the form of suspending hoops or loops, from which the lamp is suspended, and the corresponding hoops or loops, with which they engage in the ceiling (or other locality where the lamps are used), are the positive and negative poles of the current-generating apparatus. Thus, by the simple act of suspension, the lamp is placed in circuit.

"I will now specify a construction whereby the protecting globe surrounding the light can be raised and lowered for convenience in renewing carbons and handling the lamp. This I accomplish by making the platform or gallery *O*, upon which the globe rests, vertically adjustable upon a rod *O'*, attached to the lamp frame in any convenient manner. A set-screw should be provided, whereby the globe can be adjusted to any desired position. By this arrangement the work of renewing carbons and the reliable adjustment of the globe in relation to the voltaic arc materially assisted.

"In order to accommodate long sticks of carbon, the platform or gallery *O* should be perforated to allow passage down through it of said carbon sticks. I prefer making the platform or gallery *O* of metal, and of such shape as that globules of molten copper from the coverings of the carbon, in dropping away, shall not escape to do damage.

"It will be particularly observed that in the form of dash pot employed the cylinder is the movable and the piston or plunger the stationary element. This construction implies more than a mere reversal of the usual make and operation of the dash pot, for by making the cylinder the movable element the general construction of a lamp can very often be materially simplified, as in the present instance. This form of dash pot is designed to be employed in connection with any of the moving parts of the mechanism of an electric lamp, where it is desired to retard a downward movement."

The lamp covered by patent No. 203,411 is referred to only for the purpose of illustrating the operation of the invention in suit, and the complainant's right to the relief prayed for does not depend upon the validity of that patent. The lower carbon of this lamp is held in a fixed position, and its upper carbon is carried by a sliding rod which passes through a ring clamp just large enough to permit it to slide freely through when the clamp lies flat on the floor of the regulator case, but which binds upon the rod when it is lifted by one edge. The lifter, which is upon the edge of the clamp, is attached to a soft iron core which plays inside a wire helix, through which the current producing the light circulates. The attracting strength of this coil is proportionate to the strength of the current flowing through it. When there is no current flowing through the lamp the coil has no attraction at all, and the core consequently rests at the lowest limit and the ring clamp lies flat on its floor. In that situation the carbon rod slips freely through the clamp and the upper carbon rests in contact with the lower one.

Upon the establishment of the current through the lamp it passes through the carbons with little resistance, because they are in actual contact. The circuit is, therefore, a strong one and energizes the coil strongly, and it in turn attracts the core strongly and pulls it downward. This movement being communicated to the lifter it, in turn, first lifts the ring clamp by one edge, which causes it to impinge closely upon the rod, and then lifts the rod and carbon, and so separates the carbon points. This establishes the arc. But the arc introduces a resistance to the current which diminishes its strength, the resistance increasing as the arc grows longer. Hence, as the arc lengthens by the consumption of the carbons and the increase of the space between them, the current grows weaker, and the attracting power of the coil diminishes until it lets the core move downward sufficiently to release the grasp of the clamp on the rod, so that it slips downward. As the upper carbon approaches the lower and so shortens the arc and diminishes its resistance, the current's strength increases, the coil again pulls the core upward and so tightens the clamp upon the rod and thus holds the upper carbon suspended at its normal distance from the lower. This process goes on until the carbons are consumed.

It will be observed from the description of the lamp in suit that when the current is first passed through it, the current divides at the lamp and passes through both pairs of carbons and instantly energizing the solenoids, draws upwardly the cores, and through the bar $E^2$, link $E^3$ lever $E$ and lifter $D$, separates the pairs of carbons $A^1$. The separation of this pair of carbons does not operate to break the circuit and form an arc between them, but simply diverts the entire current through the remaining and unseparated pair of carbons $A$. The lifter $D$, continuing to rise, next separates the carbons $A$, thereby interrupting the circuit and establishing the arc between the last separated pair of carbons $A$. After the arc has been established between one pair, the carbons of the remaining pair are held separated by the ring clamp, their initial separation being such that the idle pair will be retained in their separated relation, while the regulator automatically moves and adjusts the burning pair, to separate or approximate them, as the conditions may require to regulate the length of the arc, and also to automatically feed them to maintain the arc.

When the burning pair of carbons has been consumed, the effective pull of the solenoids is diminished to such an extent that the carbons of the idle pair are brought into contact, which causes the entire circuit to be instantly diverted through them, the effect of which is to strengthen the solenoids and separate the carbons and automatically establish the arc between them.

The separation of the two pair of carbons, so that the arc is established between one pair, and maintained between the carbons of that pair until they have been consumed, and then automatically established between the carbons of the other pair and maintained between them until they have been consumed is a dissimultaneous and successive arc-forming separation, and it is this feature which distinguishes the lamp in suit from all prior lamps.

The six claims of the patent which it is alleged are infringed read:

4. In an electric lamp two or more pairs or sets of carbons, "in combination with mechanism constructed to separate said pairs dissimultaneously or successively, substantially as and for the purpose specified.

2. In an electric lamp, two or more pairs or sets of carbons in combination with mechanism constructed to separate said pairs dissimultaneously or successively and establish the electric light between the members of but one pair (to wit, the pair last separated), while the member of the remaining pair or pairs are maintained in a separated relation, substantially as shown.

3. In an electric lamp having more than one pair or set of carbons, the combination, with said carbon sets or pairs, of mechanism constructed to impart to them independent and dissimultaneously separating and feeding movements, whereby the electric light will be established between the members of but one of said pairs or sets at a time, while the members of the remaining pair or pairs are maintained in a separate relation substantially as shown.

4. In a single electric lamp, two or more pairs or sets of carbons, all placed in circuit, so that when their members are in contact the current may pass freely through all said pairs alike, in combination with mechanism constructed to separate said pairs dissimultaneously or successively, substantially as and for the purpose shown.

5. In an electric lamp, wherein more than one set or pairs of carbons are employed, the lifter $D$ or its equivalent, moved by any suitable means, and constructed to act upon said carbons or carbon holders dissimultaneously, or successively and substantially, as and for the purpose shown.

6. In an electric lamp wherein more than one pair or set of carbons are employed, a clamp $C$ or its equivalent, for each said pair or set, said clamp $C$ adapted to grasp and move said carbons or carbon holders dissimultaneously or successively, substantially as and for the purpose shown."

It is admitted by the defendants' counsel that the patent in suit describes a new and useful mechanism for which Brush was entitled to a patent; but it is urged that the first, second, third and fourth claims are for functions or results without regard to mechanism, and are, therefore, void.

The claims are not open to this objection. The specification describes mechanism whereby a result may be accomplished, and the claims are not for mere functions, nor fairly construed, can it be said that they cover other than equivalent means employed to perform the same functions. The first claim, construed in connection with the means described in the specification, is for an arc lamp in which two or more pairs of carbons are used, the adjustable carbons of each pair being independently regulated by one and the same mechanism, and in which there is a dissimultaneous or successive separation of the pairs, so effected as to secure the continuous burning of one pair prior to the establishment of the arc between the other pair. Thus construed the invention claimed is limited to the particular means described in the specification and their substantial equivalents.

The second, third and fourth claims also refer to the particular mechanisms described in the specification for the accomplishment of results covered by these claims. They are for combinations of specific mechanisms and their substantial equivalents, and not for results irrespective of means for their accomplishment.

It is true that in the specification Brush declared, "I do not in any degree limit myself to any specific method or mechanism for lifting, moving or separating the carbon points, or their holders, so long as the particular functions and results hereinafter to be specified shall be accomplished."

He did not say, however, that he claimed all mechanisms irrespective of their construction and modes of operation. By this language he simply notified the public that he did not restrict himself to the particular lamp described in the patent, but that his invention embraced *that* and all other lamps operated substantially the same way by equivalent mechanism.

It is urged that the fifth claim covers the lifter simply, and that the sixth claim covers nothing but the clamps, and being only for detached parts of the lamp, incapable of separately performing the function ascribed to them, and these claims are void.

The fifth claim is for a combination of which the lifter $D$ is an element, and thus construed, the claim is for a novel and useful invention.

The sixth claim is not for the two clamps aside from other connected mechanism. It is for the two clamps in combination with the mechanism described in the patent for actuating the clamps and causing them to grasp and move the carbons dissimultaneously, substantially as and for the purpose described in the specification.

Patent No. 147,827, issued to Matthias Day, Jr., Feb. 24, 1874, is relied on as an anticipation of the first, second and fourth claims of the patent in suit. This defense is based upon a construction of these claims that gives no effect to their concluding restrictive language, which construction, we have seen, is not authorized. The patent in suit describes mechanism which designedly and positively effects a dissimultaneous separation of the carbons, and Professor Barker, the defendants' expert, testified that the Day lamp was not so constructed, and did not so operate. It is true that the Day patent describes a lamp which contains two or more pairs of carbons, but not such a double carbon lamp as Brush invented. In the Day lamp each carbon is split or divided vertically for a slight distance from the outer end, but so rigidly connected at the clamp extremity as to act solely as a pair of separate carbons, and not as "two or more independent pairs or sets of carbons."

Owing to the constant and frequent shifting of the arc from one pair of carbons to the other in this lamp, it produced an irregular and unsatisfactory light. It was unlike the Brush lamp both in construction and mode of operation.

The answer also denies infringement, but that defense, like the last one, is based on the theory that the claims are not at all limited by their concluding language. It is plain from the evidence that the defendants' lamp was designedly constructed so as to insure the dissimultaneous separation of the two pairs of carbons for the purpose of forming the arc between one pair only of the carbons, and that both lamps operate identically the same way and for the same purpose. The patent describes a ring clamp and the defendants use a hinged clamp; but there is not the slightest functional difference between them. Both operate by grasping and holding with varying pressure the smooth rod which carries the carbons, thus allowing the rod to slide so as to secure a continuous feed by inappreciable degrees, while, under other conditions, the cord is allowed to slip suddenly by gravity. The ring clamp was old, and Brush simply employed it as as suitable for his purpose in combination with other elements with which it co-acts, and the substitution of the hinged clamp, without any change in the mode of operation or function, did not change the combination.

In the Brush lamp the clamps rest on a flat floor, and the arms of the lifter are of unequal length, so that when the lifter is raised one clamp is tilted in advance of the other, and the carbons are separated dissimultaneously. In the defendants' lamp the same result is accomplished by supporting the clamps in different planes, and employing a lifter with arms of the same length, so that in the operation of the lifter it will tilt one clamp in advance of the other. Brush did not claim that there was invention in the lifter and clamps disconnected with other parts in the operation of the lamp, and the defendants cannot escape infringement by showing that they use a lifter and clamps not identical in construction with the lifter and clamps described in the patent. It is admitted that if the claims are construed as embracing the mechanism described in the specification the defendants use a lamp covered by the patent in suit, and that renders a further description of defendants' lamp unnecessary.

It is finally contended that, while the patent describes particular mechanism by which the functions stated in the claims can be performed, the patentee expressly declared in his specification that he did not limit himself to this mechanism, or its equivalent, but claimed that his invention comprehended all means capable of accomplishing the results stated, and that having thus claimed more than he was entitled to, the complainant cannot recover until he disclaims everything in the specification except the specific mechanism.

An application for letters patent is accompanied by a specification giving a full general description of the alleged invention, and this is followed by what is known and well understood in the courts, as well as the Patent Office, as a "claim." What the patentee invents and decribes in his specification, but fails to embrace in his claim, he abandons to the public, unless by timely application he obtains a reissue for it, and if in the descriptive part of his invention he inadvertently, or otherwise, includes as a part of his invention that which is old, but does not claim it, his claim is not thereby invalidated. Such part of the specification is surplusage. It is only when the claim following the specification is too broad, in the sense of embracing something as new which is not new, that the patentee is required by Section 4,922 to disclaim. He is not required to disclaim anything in the specification not covered by his claim. The word "specification" is obviously used in the first clause of Section 4,922 as synonymous with "claim." I am aware of no decision holding that a patentee is required to disclaim anything in the discriptive part of his invention which is not fairly embraced within his claim.

In Railroad Company *vs.* Mellem, 104 U. S. 118, the court said: "In view, therefore of the statute, the practice of the Patent Office and the decisions of this court, we think that the scope of letters patent should be limited to the invention covered by the claim, and that though the claim may be illustrated, it cannot be enlarged by the language used in other parts of the specification. We are, therefore, justified in looking to the 'claim' with which the specification of the appellee's invention concludes to determine what is covered by this letters patent."

It is not material for the purpose of this suit whether Brush was a pioneer, or a mere improver. It is sufficient that he described and illustrated in the patent in suit a specific mechanism, or double-carbon lamp, adapted to burn its carbons independently and successively; that he was the first to accomplish this result, and that the claims are for mechanism substantially as described in the patent in combination with two or more pairs of carbons or sets of carbons for producing the result specified. We have already stated that what is claimed is not functions and results, but mechanism for producing functions and results.

A decree will be entered in accordance with the prayer of the bill. M. D. Leggett & L. L. Leggett, H. A. Seymour, for complainant; R. S. Taylor, for defendant.

## Annual Report of the Brooklyn Subway Board.

The Board of Electrical Subway Commissioners in Brooklyn has made this report to Mayor Chapin:

"The total mileage of conductors now underground in the city (apart from city wires) is 3,007 miles; on the elevated railways (apart from electric light wires), 768 miles. The aggregate thus far removed from housetops and poles is larger than the total of aerial telegraph and telephone wires existing in the city in 1885. The total number of poles removed this year, not including those removed by the electric light companies, from which no report has been received, is 445. The telephone wires have been removed from 271 poles, which are still standing because they carry city wires. The total number of poles, says the report, which would have been removed if the necessary co-operation of the city had not been delayed, is 667."

The board makes these suggestions:

1. Since the space under the streets is limited, the city ought not to surrender it beyond recovery, on reasonable terms, to any private company.

2. The placing of telegraph and telephone wires underground may be continued without fear of interfering with the future comprehensive system.

3. It is of the highest importance that the city itself should take the lead in this matter by putting its police and fire telegraph lines underground.

4. Either the executive authority controlling the electrica con ductors should also make contracts for street lighting, or the department making such contracts should act in harmony with it and according to its advice.

## Interior Wiring in Boston.

A committee, composed of F. A. Gilbert, G. E. Cabot and D. Killecutt, has reported the following to Capt. Damrell, inspector of buildings in Boston:

Your committee appointed to report upon "Electric Wires inside of Buildings," would recommend the enactment of laws substantially as follows:

For arc light and power wires, or others designed to carry current of over 250 volts electromotive force:

That they shall not be placed so as to be concealed from view.

That they shall not be allowed in contact with wood or other inflammable building material that may become carbonized, but that they shall be separated from such material by at least one-half inch air space by use of non-combustible, non-carbonizable insulators, placed near enough to prevent contact of the wires by sagging or otherwise, but not further than six feet apart.

That with such construction, wires of opposite polarity shall not approach each other nearer than ten inches, except at the lamp and switch.

If the wires are incased in insulating tubing that is impervious to moisture, will not support combustion, and of sufficient mechanical strength to protect them from injury, the tubes may be laid as near as three inches to each other and may be fastened to any building material by use of staples or such other means as will not injure the tubing.

All such wires must enter and leave the building at the same place in order that a non combustible hand switch may be placed outside for the use of shutting off the current.

An insulating covering, that will support combustion, will not be allowed.

For incandescent light and power wires, or others designed to carry currents of less than 250 volts electromotive force:

If such wires are concealed within partitions or like places they must not be allowed in contact with wood or other inflammable building material that they may become carbonized, nor with any conducting material such as piping or other wires.

They must be rigidly separated from such material by at least one-half inch air space, by the use of non-combustible, non carbonizable insulators, placed at intervals near enough to prevent contact by sagging of the wires or otherwise.

The wires must be kept at least six inches apart, except where they enter junction boxes, cut-outs or the like.

Wires laid in plaster, cement or other similar building material will not be allowed, no matter what insulating covering may be used.

In lieu of construction by air space and non-combustible insulators, wires may be incased in insulating tubing that is impervious to moisture, will not support combustion, and of sufficient mechanical strength to protect them from injury, and such tubes may be laid side by side, in plaster, cement or similar finish, or in any concealed space where they will not be subjected to injury, and may be supported by staples or such other means as shall not injure the tubing.

No switch or safety cut-out except those made of non-combustible material will be allowed.

For telegraph, telephone, messenger service and all other electric wires not heretofore mentioned, except public fire alarm and police wires and "series" electric light wires:

All such wires in any town or city in this Commonwealth where electric lights or power wires are being operated, must be provided at the entrance of any building (both ingoing and outgoing wires) with some safety device that shall instantly open the circuit or shunt the current out of the building in case the flow of current shall at any time exceed in quantity or electromotive force that which is normally used on such wires.

Such safety device must be located as near as possible to the place where the wires enter the building, and in some place easy of access.

When the safety device is placed inside of the building, the wire connecting it with the outside wire must be of equal or greater carrying capacity.

The device must be mounted on non-combustible material.

All switches, cut-outs, insulators, insulation or tubing for use in electric lighting or power work, and all safety devices herein referred to must be approved by the committee or inspector in power, before being used.

# Special Correspondence.

## NEW YORK NOTES.

Office of The Electrical World,
167-177 Times Building, New York, Dec. 28, 1889.

**Visitors in Town.**—Among the electrical men in town the past week were T. McCoubray, of Boston; A. E. Braddell, of Philadelphia; Floyd Platt, of Kansas City, and Mr. Silverman, of Pittsburgh.

**The Standard Paint Company,** 59 Maiden Lane, has issued with the compliments of President R. L. Shainwald, a very pretty little pamphlet calendar for 1890. It is well worth owning. On the back cover is brief mention of the P. & B. paints, electrical compounds and building, insulating and wrapping papers.

**The Goubert Manufacturing Company** are making a Goubert feed water heater of 5,000 h. p. for the New York Steam Company to go in the steam plant of the Safety Electric Light and Power Company, on Washington street. It is one of two for the same use, and is said to be the largest heater ever made.

**Mr. J. D. Bishop,** who was associated with Mr. W. D. Sargent in charge of the telephone exhibit at Paris, has become superintendent of the Norwich Insulated Wire Company, of 58 Cedar street, with factory in Brooklyn. The president of the company is Louis D. Beck and the secretary and treasurer is J. B. Atherton. The company makes paper-insulated wire and cable, and other forms, under special patents.

**Motors in a Candy Factory.**—Mr. Lufkin, of the C. & C. Motor Company, informs me that his company has fitted out the Huyler candy factory, Eighteenth street and Irving Place, with 75 h. p., on the same general plan as that employed in the C. & C. factory. Bus wires are run to each of the six floors of Huyler's factory and the individual motors run the machines on each floor. A saving of twenty-five per cent in the coal bills is guaranteed. The company are actively engaged filling general orders from all over the country.

**Lighting the New York Hospital.**—Hatzel & Buehler, 29 W. Twenty-sixth street, have just finished the equipment of this hospital for electric lighting. It is the first hospital so lighted in this city, and I doubt if there are many others in the world. The total number of lamps is 675, of 16 c. p. The entire gas system has been duplicated. The current is supplied by the local Edison Company from its street mains. The wiring, construction, etc., was done under the direct supervision of Mr. J. Buehler, ably assisted by his foreman, Mr. L. J. Bowen.

**Chas. A. Schieren & Co.,** of New York, Chicago, Boston and Philadelphia, have been awarded a medal at the American Institute Fair for the superiority of their leather belting. The American Institute has awarded them medals consecutively from 1869 to 1889. They have received numerous other awards: Philadelphia Centennial, 1876; Franklin Institute, 1884, for their electric belts; Liverpool International Exhibition, 1886, for their "Electric belts," and the late 1889 Paris Exposition they were awarded two medals, one for the superiority of their "Electric" and "Perforated Electric" belts, and the other for their "Leather Link" belts. The main belt which drove the machinery for the whole American section was of their manufacture.

**Mr. G. W. Silsby** has closed a contract for a complete Edison plant for the Antietam Paper Mills, Hagerstown, Md., and has already nearly finished it. He has also closed contracts for a 720 light, 16 c. p., central station at Beverly, N. J., and one at Martinsburg, W. Va., of 1,000 Edison 16 c. p., 100 32 c. p. Municipal and 25 Sperry arcs, with two McIntosh & Seymour compound tandem 100 h. p. engines. A 100 h. p. water power will also be utilized. A short electrical road will be built and will be operated from the station, and a small woolen mill will be run during the day. Col. George Truesdell, President of the Eckington Electric Railroad, Washington, and Mr. B. H. Warner, President of the Columbia National Bank, Washington, are large stockholders in the enterprise, and U. S. Senator C. J. Faulkner is a director.

**The Lodge & Davis Machine Tool Company.**—I note with pleasure that the Lodge & Davis Machine Tool Company has opened to the public at 64 Cortlandt street a new store for the exhibition and sale of their improved iron and brass working tools. They will carry in stock there a full line of all the machinery manufactured by them. This, they claim, is due to the great success they have with their Chicago store since its opening, March 1, 1888, and the increased demand for their tools in the East. The New York store is under the management of Mr. H. W. Harrison (late of E. P. Bullard), who has a thorough and perfect knowledge of machine tools and an extensive acquaintance with the manufacturing interests of this section of the country. With great business foresight, the firm have enlarged their capacity, and by their enterprise have secured a large and active trade all throughout the United States. They have recently added considerably to their works at Cincinnati, and are now able to produce a large quantity of their goods. The introduction of progressive ideas in their tools, by building them on sound mechanical principle

made the demand so large that the output of this firm is greater than ever.

**Mr. E. T. Lynch, Jr.,** has secured the contract for the central station plant to be erected at Hampton, Va. This plant will light Hampton and has a five years' exclusive contract with that city. The plant will also supply light and power to the Virginia Normal School and the National Soldiers' Home Institutions. These institutions will require some four thousand incandescent and some forty arc lights. The station will also supply several thousand incandescent lights to Chesapeake City and Fortress Monroe. The longest incandescent circuit will not be over three miles straightaway. The contract calls for the best construction, and all machinery must be of the most approved type. High speed engines will be used and the three-wire or alternating systems for incandescent lighting. This station when complete will be one of the model plants of the South, and the enterprise of capitalists in investing so largely in the face of New York troubles speaks very favorably for their confidence in electric lighting. The total lighting will be about 8,100 incandescents and 50 arcs.

W. T. H.

## NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, Dec. 28, 1889.

**Concord, N. H.,** will have a Thomson-Houston system of electric railways in the near future.

**Orange, Mass.**—A project is on foot to connect Orange and Athol, Mass., by an electric railway, and it is expected that it will be carried into effect next Summer.

**Wakefield, Mass.**—The board of gas commissioners has granted the petition of the Citizens' Gas Light Company, of Wakefield, to do electric lighting in Wakefield and Reading, with a prescribed minimum capacity of 60 h. p.

**Mr. J. P. McQuaide,** general manager of the National Conduit Manufacturing Company, of New York, was on a visit to his friends in Boston this week. Mr. McQuaide is always welcome, and the only desire is that he would come more frequently.

**Mr. W. E. Stowe,** the popular superintendent of the Wright Electrical Engineering Company, was presented by the various foremen of the company with a beautiful Masonic ring, set with diamonds, as a Christmas token of their regard and respect.

**Boston Electric Club.**—A paper entitled "An Inquiry into the Covering of Steam Pipes, Boilers, etc., to Prevent Loss of Power by Radiation of Heat," was read by Mr. F. C. Childs at the club rooms on Monday night, and enjoyed by a large number of members and friends. A general discussion followed.

**Electric Doors for the Tremont Theatre.**—This theatre is now fitted with electric doors, which can be opened by simply touching one of eight push buttons situated in convenient places in the theatre. On the slightest alarm 17 sets of folding doors are immediately and simultaneously thrown open by the electric circuit, doing away in a large measure with the danger of being trampled to death in cases of panic.

**The Standard Electric Company of Vermont,** has sold to the Western Coal Machinery Company for installation at Beatrice, Neb., a 1,000 light incandescent plant, which was sold chiefly on its merits as a low speed and low voltage of dynamo, and on account of its extreme lightness for the work developed. The Standard Company will furnish all the material, and will send a man to superintend the installation. This company has also sold a 200-light plant to the Holyoke Paper Company, Holyoke, Mass.

**The Jewell Belting Company,** of Hartford, Conn., has opened a branch warehouse, salesroom and office at 147 Oxford street, Lynn. The branch office will be under the management of Mr. Charles L. Tolles, who has been connected with the home house for several years, assisted by Mr. J. H. Fitzpatrick, of Salem, Mass. A complete line of belting will be kept in stock, and prompt shipments may be expected, as there will be telephonic communication between the two offices.

**Beverly, Mass.**—The Beverly & Danvers Electric Railroad Company have voted to lease the road to the Union Electric Car Company, of Boston, who are at present operating the road with cars fitted with storage batteries, and furnished with their patent gearing. The Union Electric Car Company will guarantee a certain per cent. for dividends, and so successfully have the cars run that they will extend the tracks in the spring, both in Beverly and Danvers.

**A Seamless Rubber Belt.**—Following the necessities of the times, when perfect belting is so essential to the success of an electric light plant, the Boston Belting Company have succeeded in making a rubber belt which has no seam on the surface. The belt really consists of two belts which have seams on the inner adjacent side, and which are rolled together and vulcanized, so that when finished the whole makes one solid belt without any seam visible. The belt then presents two perfectly smooth surfaces, and forms an ideal rubber belt for driving dynamos.

**Mr. H. M. Underwood,** whose address in Boston is Post Office box 3,453, has recently been appointed New England agent of the Interior Electrical Conduit Company, of New York. Mr. Underwood reports that he is equipping the Memorial Hall at Rockville, Conn., with the complete system of interior conduits for 225 lights, comprising junction boxes, cut-out boxes, etc About 10,000 feet of conduit will be used. In the Shoe and Leather Building, Boston, there is being installed about 8,000 feet of this conduit, and the highest expectations of its efficiency are being fulfilled.

**Springfield, Mass.**—The advocates of the single trolley system have secured an important victory in Springfield, Mass., the aldermen having unanimously voted to grant the street railway company permission to operate the line from State street to Forest Park by the single trolley system of electric power. The order granting the petition provides for guard wires where deemed necessary, and that the feeder wires be placed underground whenever so ordered by a board of supervisors. In any case of emergency by fire, the city reserves the right to cut the trolley wire, which is to be repaired at the expense of the railway company.

**The West End Street Railway Company.**—The Warren street line of cars will commence this week to be run by electricity from the temporary power station on Albany street Complete electric car communication will be made between Grove Hall and the northern depots, by way of Shawmut avenue, Tremont, Hanover, Portland and Canal streets, returning by Portland, Merrimac and Sudbury streets. Regular stopping places have been assigned, so as to allow the cars to develop some speed, though no stoppages will be made at these places unless passengers desire to get on or off the car. An electric night car will be run between Grove Hall and the Tremont House every hour after midnight.

**The Wainwright Manufacturing Company, of Massachusetts,** has sold a 200 h. p. heater for the Westinghouse plant of the Amherst Gas Company, at Amherst, Mass. The Wainwright Company are introducing just now a patent expansion tube, to be used in connection with compound engines between the high and low pressure cylinders, and which are simple, very durable and perform their work in a highly satisfactory manner. The expansion joint consists of a No. 17 gauge corrugated copper tube connected to heavy cast iron flanges, and makes a straight connection between the two cylinders, adding with its bright surface much to the appearance of the engine. The price is extremely low, and there are already over 125 in use with prominent engine builders.

**Electric Lights for Boston.**—Mayor Hart has not accepted the bids of the electric light companies for furnishing street lights for Boston, holding the opinion, which he has derived from his recent visits to other cities, that Boston ought to have cheaper lights. The present contracts expire on Jan. 7, and unless some definite arrangement is made soon Mayor Hart will order the gas turned on. While the price of electric lights in Boston is exciting attention at present, a wholesome warning not to reduce the price too far might be had by turning Mayor Hart's attention to the condition of New York. The aim of Boston at present ought to be and is to maintain its superior construction, and due consideration should be given to the value of the construction work before it is decided what a fair figure for lighting would be. Too cheap lighting would undoubtedly mean too cheap construction, and lead to endless trouble between the electric light companies and the insurance inspectors.

**Kendal & Slade** have now completed their extensive alterations and additions to their offices at 43 Milk Street, Boston, and have now very complete and cosy quarters. They have added large and convenient stock rooms and workroom, and each of their 52 workmen has a separate closet, with lock and key, for the safe-keeping of his tools and other property. Kendal & Slade have now a first-class supply of all electrical goods, and will ship promptly anything required in the business of electric light or power, and all the innumerable articles required in bell wiring, gas lighting, house wiring, etc. Kendal & Slade are enabled to furnish very promptly first-class cedar poles, and within the past week or two have shipped as many as 6,200. Besides dealing in general electrical supplies, they carry on an extensive contract business, and they have just completed wiring the City Hall at Haverhill, Mass., for 700 lights. This building has also been equipped by them with frictional electric gas lighting apparatus for 300 burners. They are also engaged in wiring the factory of Robert Bishop, South Boston, for 200 lights; the Soldiers' Home, Chelsea, 250 lights, and George Upton's glue factories in Peabody and Salem, Mass., where they had to use a very special insulation, the wires, in many instances, running directly over the large glue boilers. Kendal & Slade are also engaged in a large amount of construction work in Lynn, made necessary by the recent fire.

A. C. S.

## PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 CITY TRUST BUILDING. PHILADELPHIA, Dec. 28, 1889.

**Reflectors for Incandescent Lamps,** either in glass or polished metal, can be obtained at the show rooms of the American Reflector Company, 132 North Fifth street.

**Bullock & Cranshaw,** 528 Arch street, are devoting special attention to the importation of blue vitriol, chloride-ammonia, mercury, chromic acid, bichromate of potash, and sulphuric acid.

**New Arc-Light Globe.**—Mr. D. Hyman, manager and electrician of the Excelsior Electric Company, Harrisburg, Pa., has obtained a patent on a new arc globe for street use. This new globe possesses, I have heard, several novel features.

**Cornelius & Rowland** have added several new designs in combination (gas and electric) fixtures and electroliers to the varied and attractive stocks at their showrooms, No. 1,612 Chestnut street, Philadelphia, and 324 North Charles street, Baltimore. This firm merits the attention of purchasers in their line.

**The Dynamograph Company.**—A committee of the directors of this company report having made a thorough examination of Mr. J. F. McLaughlin's electrical typewriter. They find great progress to have been made toward the production of a practical "dynamograph," and consider that it already "promises greater results than those of its only rival, the telephone."

**The Electric Car Company of America** has its works at the corner of Washington avenue and Twenty-third street. This company's extensive works occupy nearly an entire block, and are equipped with new and expensive machinery for the manufacture of electric motors and electrical devices of various kinds for use on electric street cars. This company's new motor is about ready to be placed in the market.

**Electrical Execution.**—The Philadelphia *Press* contained the following paragraph in its December 26 issue: 'A report comes that the Court of Appeals is likely to declare the law which compels the use of electricity to put condemned men to death unconstitutional. There is no good reason to believe that the court has decided, but if the report is true, an interesting question will arise about the disposition to be made of three criminals now under sentence of death by electricity."

**"'Tis Pity 'tis True."**—Our good friend Cleverly undertook recently to supply each of his customers and friends with an attractive calendar for 1890, and had a thousand (in two sizes) printed on the finest of bristol. These were mailed to every section of the country before the present month had fairly opened, but applications for more calendars have been coming in so thick and fast on Mr. Cleverly that it will be necessary to have at least a carload more printed to satisfy the demand.

**Lecture on Steam Horse-Power.**—Mr. Thomas Pray, M. E. C. E., of Boston, for several years a journalist at the "Hub," and more recently identified with electrical and engineering interests, delivered a very interesting lecture at the Franklin Institute on Friday evening, Dec. 20. Subject: "What Does a Steam Horse-Power Cost?" The audience was a large one, and comprised many scientific and experienced individuals. Mr. Pray's remarks were listened to attentively and favorably commented upon.

**Daft Motor Car.**—In the early part of the week a handsome car, bearing the above name, appeared on the tracks of the Market street line, and daily since then has made frequent trips between Forty-first and Fiftieth streets on the line mentioned. Inquiry elicited the information that the beautiful stranger came from the John G. Brill Company's Car Works, and was simply making experimental trips prior to being forwarded to another section of the country. The car is equipped with Daft electric motors and ninety cells of storage batteries of the Electrical Accummulator Company's make.

**New Storage Battery.**—Mr. J. F. McLaughlin, of this city, has been successfully experimenting with his new storage battery during the past week, operating an ordinary sized street car on the Germantown branch of the People's Line Railway. The car is equipped with 54 cells of McLaughlin accumulators and a 15 h. p. Sprague motor, and attached to each platform is a new device, which will start and stop the car, or regulate its speed by a slight movement of a lever. This device with its novel electrical and mechanical connections may yet prove an important factor in the propulsion of street cars by electricity.

**The "Otto" Gas Engine Works** recently supplied two of its engines—40 and 50 h. p., respectively—to the gas light company of Racine, Wis., for use in the electric light station in that city. The results obtained from these engines proved not only satisfactory but exceedingly economical, and an order has just been received by Schleicher, Schumm & Co. from the Racine Gas Light Company for a 100 h. p. "Otto" gas engine. This engine when finished will be the largest gas engine ever built in this country. It will be shipped to and used at the electric light station in Oshkosh, Wis., which is owned and operated by the people in the Racine enterprise.

**New Station Work.**—Mr. G. A. Wilbur, of this city, the Pennsylvania representative of the Fort Wayne Electric Company, has handed me particulars relative to the new electric light station at Media, Pa. The plant consists of a 35 arc light machine of the new Wood pattern and a 50 h. p. Ball engine. "The distinctive feature of the new Wood machine," said Mr. Wilbur, "is its automatic current regulator, which controls the current perfectly and allows the full load to be thrown on and off the dynamo without endangering the machine." The residents of Media are highly entnused over the introduction in their town of electric lights as an illuminant, and the business men are hastening to get in their orders for commercial lights. Another 35-light Wood machine will be installed at an early day.

**Electric Light Conference.**—Representatives of the various electric lighting companies in Philadelphia were in conference yesterday with Superintendent Walker and Director Wagner, of the Board of Public Works, concerning the terms under which contracts for electric lighting will be made next year. It was determined that bids shall be made according to ampèrage and voltage; the proposals setting forth the amount of the current to be furnished and the voltage of each lamp. Each circuit will be provided with a test station, so that the city employés can ascertain at any time the strength of the currents passing over the wires. The standard required of the lamps will be 1,000 c. p. Recent tests have shown that the city lamps lose 27 per cent. of their brilliancy by reason of dirty globes. Next year the globes will be one-quarter frosted.

**The J. G. Brill Company,** of Philadelphia, the widely known car builders, are erecting new car works at the corner of Woodlawn avenue and Sixtieth street, to be ready for occupancy about the first week in January. Already has begun the process of moving from the present works at Thirty-first and Chestnut streets, and the change will be gradually effected in order that the business of the firm may not be interrupted. At the new works the facilities for turning out cars will be more than double those afforded at the present premises. Until within a few months the J. G. Brill Company gave very little attention to the manufacture of street cars for electric propulsion, but at the present time they are making a large number of electric cars, not only for Philadelphia, but for shipment to all parts of the country, these being for use in connection with trolley, conduit and storage battery systems.

**De Kosenko & Hetherington,** of Philadelphia, designers and manufacturers of combination (electric and gas) fixtures and electroliers, report having filled orders recently as follows: At the Girard Life and Trust Company's new building with upward of four hundred fixtures—combination and electroliers—all specially designed and manufactured by this firm. On the lower floors and principal corridors the fixtures are of statuary bronze, while those on the upper floors are of the finest nickel. The Union Trust Company's new building, on the site of the old Masonic Temple, is fitted up throughout with specially designed chandeliers (combination gas and electricity) and electroliers in oxidized bronze. At the large office building of the Fred. Brown Estate, corner Fifth and Chestnut streets, the combination chandeliers and brackets are of ornamental brass and wrought iron; and the new Art Club on Broad street, combination fixtures for gas and electricity in wrought iron, ornamental silver and polished old brass.

**The Baxter Motor Company.**—The Baltimore *Sun* of recent date had the following: "Creditors and stockholders of the Baxter Electric Manufacturing and Motor Company, of Baltimore, have completed negotiations for the organization of a new corporation and for continuing operations upon a strong basis. These negotiations have been in progress for months, and those interested in securing the results have had plenty of work. A year ago the old company executed a deed of trust, and the concern has been continued under the Receivers or by other arrangements in which the Receivers were the advisers. An auction sale of the entire property and assets at Receivers' sale had been announced to take place on Dec. 30 by J. Frank Morrison and Luther M. Reynolds, with Alfred J. Carr, attorney. The purchase by creditors and stockholders has stopped the Receivers' sale, and the new company will be incorporated next week. Principals in securing the establishment of the new enterprise state that the corporation will be in the hands of men whose names as directors will be a guarantee of strength. A capital stock of $200,000, of which about $150,000 will be direct working capital, including material on hand, will give a good start, and as the business demands it more money will be forthcoming. Creditors will get stock for the amount of their claims, and the property passes into the possession of the new company free of incumbrance. These Baxter works are extensive in their proportions, and with the capital to develop the business they will become among the most important in the country. The capital is now understood to be forthcoming. Messrs. Deford, Bartlett, Hilles, Hight, and other Baltimore business men are said to be interested in the reorganization."

**The Horn, Brannen & Forsyth Manufacturing Company,** of Philadelphia, are one of the oldest established houses in their line in this country. As manufacturers of gas and electric light fixtures, electroliers and art brass and metal work, they have acquired a widespread reputation for the attractiveness and durability of their goods. The company's extensive manufacturing establishment, in which are the show rooms and offices, occupy nearly the entire block bounded by Broad street, Pennsylvania avenue and Hamilton street. The officers of the company are: Henry Donohue, president; James Brannen, treasurer; Herman Horn superintendent, and C. S. Forsyth, secretary. All of these gentlemen take an active interest in promoting the welfare of their mammoth enterprise, and individually take pride in being found at the factory six days every week by their customers and friends. Many public buildings and institutions, hotels, club-houses and residences in Philadelphia, Baltimore, Washington and other cities and towns throughout the country are fitted up with combination gas and electric light fixtures manufactured by the Horn, Branneu & Forsyth Manufacturing Company. Orders recently filled in this city by the company in combination fixtures are as follows: United States post office, antique brass; Brown Brothers & Co.'s bank building, oxidized silver

the Land Title and Trust Company's new building, antique brass; and the Real Estate Title Company's building, antique brass. The same kind of fixtures, but in each case differing in design and finish, have been sold during the past month as follows; Pennsylvania railroad stations at Harrisburg, Pa., and Altoona, Pa., respectively, wrought iron and antique brass; the Union railway station at Indianapolis, Ind., fancy brass; Chamber of Commerce, Cincinnati, wrought iron and artistic bronze; and the business offices of the Pennsylvania Railroad at Pittsburgh, artistic bronze and brass fixtures. The company are at present filling an order in wrought-iron fixtures of highly artistic design at the new Carnegie Library Building, Allegheny, Pa. W. I. B.

## WESTERN NOTES.

Branch Office of The Electrical World,
39 Mallers Building, Chicago, Dec. 28, 1889.

**Cheap, if True.**—Some one in Chicago is offering "a half interest in the best storage battery of the age" for $5,000 in real, cold cash.

**Mr. Geo. B. Shaw,** Mayor of Eau Claire, Wis., and manager of the National Electric Company of that city, was a visitor in Chicago this week.

**The Electric Holder Company,** of East St. Louis, has been formed by F. C. Hoyt, A. H. Bacon and C. D. Kelley, with a capital stock of $50,000.

**Mr. S. B. Lowe,** Chattanooga, Tenn,. desires the address of manufacturers of watchmen's clocks, and says he "cannot find any advertisement of same."

**Mr. Hubert S. Wynkoop,** formerly in the Minneapolis office of the Leonard & Izard Company, has been transferred to their Chicago office in the Rialto building.

**The Racine, Wis., City Council** are agitating the question of forcing the overhead wires underground. As usual in such cases, the gaseous element predominates.

**The Baraga Graphite Mining Company,** Detroit, Mich., are sending out some samples of their graphite foundry facings that are being used in preparing special castings.

**The Telephone Girls.**—The Detroit *Free Press* of last Sunday had a two-column article descriptive of the telephone exchange in that city, and the excellent service rendered is highly complimented.

**Mr. Ernest Hoefer,** the Chicago agent of the Bishop Gutta Percha Company, has arranged to carry a stock of their white core wires in this city, and will thus be enabled to fill all orders promptly.

**The Municipal Electric Light Company, of St. Louis.**—The board of directors have made harmonizing changes among their officials. Brainard Rorison, secretary of the Fort Wayne Electric Company, is on the board.

**The Central Electric Company,** Chicago, have received an inquiry for prices and a request for a catalogue from a business house in South Africa, who mention seeing the card of the Central Electric Company in The Electrical World. Comment is unnecessary.

**The Monongahela Natural Gas Company** and the National Tube Works, McKeesport, Pa., are placing electric automatic registers and pressure regulators on their pipe lines that will automatically warn the engineers to increase or decrease the pressure, as the case may need.

**The Central Electric Company,** Chicago, are the general Western agents for all the productions of the Okonite Company, especially the insulated wires that are peculiarly adapted for mill and mine work. This company also carries a full line of all needed supplies required in electrical installations.

**Long Branch, N. J.**—The Long Branch Electric Light Company has begun the erection of a new dynamo house in the rear of the gas works. The building will be of brick, 120 feet long, 40 feet wide and 22 feet in height. The dynamo room at the southern extremity will be 40 × 80 feet. Contractor Brehm has been awarded the contract.

**The La Crosse, Wis., Brush Electric Light Company,** on securing the contract for additional city lights, found it necessary to install a larger engine, and thus secured a Reynolds-Corliss engine, and stated to Mr. Allis that their old engine of the same make had never lost a moment's time or required any extra repairing during the six years it had been in operation.

**The Sperry Electric Company,** Chicago, report the sale of a 100-light plant with double arc lamps at Council Bluffs; a 30 arc light plant to Blue Springs, Nebraska; an increase at Atlantic City, Iowa; a 20-light plant to the Aluminum Brass and Bronze Company, Bridgeport, Conn.; a 30-light increase at South Easton Pa., and a 20-light plant to the Lehigh Valley Railway Company for their Packerton station.

**The Knapp Electrical Works,** Chicago, are shipping large quantities of their heavily insulated Grimshaw white core wires for use in the iron and copper mines to the north, where the constant presence of moisture renders perfect insulation an absolute necessity. Mr. Knapp is also supplying the Perkins incandescent lamps to isolated plants and furnishing a number of mines with his heavy, strongly-built alarms gong and annunciators.

**J. Lang & Co.,** Chicago, are sending some special Andrews switches to Columbia College. Three of these switches of 250 ampères capacity are attached to a neat base, and arranged for connection to three separate circuits. Only the centre switch has a handle, but as all three are connected together by a rubber or fibre bar, the three circuits can be easily opened or closed by one motion. Switches of this pattern are desirable for the regulation of stage lighting.

**Death of Alfred Cowles.**—The sudden and unexpected death of Alfred Cowles, late the business manager of the Chicago *Tribune*, a director in many enterprises and president of the National Subway Company, occurred in Chicago on Dec. 20, following a double stroke of paralysis. His remains were escorted to their resting place by all the more prominent citizens, who have been associated with him in business during the past thirty-five years and who testified to his value and worth as a good citizen.

**The Imi Electric Bell Company.**—Richard A. Allen has filed in the Superior Court a bill for a receiver for the Imi Electric Bell Company. He claims that the company was formed to purchase and operate patents owned by Frederick Sanderson, and that Charles F. Sinclair was elected president and Allen secretary. It is charged that Sinclair collected over $500 from Allen, purchased the patent, claims to be the sole owner, and refuses to turn it over to the company. An accounting is asked and an order restraining Sinclair from collecting any money due the company.

**The Electrical Supply Company,** Chicago, have noticed the marked increase in orders received from mining companies for electric light and power supplies, and realizing the peculiar difficulties that are met with and that have to be overcome in the installation of electrical apparatus especially in the lower levels and distant drifts, they have given especial attention to the question of proper insulation for copper conductors, and have also added several new articles for use in the construction and the maintenance of plants rendered necessary in the application of electricity to mining.

**Mr. M. J. Carpenter,** a prominent architect, of Spokane Falls, while in Chicago last week, said: "That the town is growing so rapidly in spite of the present disadvantage, is an indication that it is the place for a big city. The immediate water power of the falls, which far surpasses the power at Minneapolis, is being used to run dynamos. Electricity for power is being used all over the city. It is cheaper to have an electric motor than a steam engine. The street cars are run with electricity and the whole town is lighted with arc and incandescent lights. The power is practically unlimited, and electricity can be made for almost nothing."

**Mr. Charles A. Brown,** manager of the Western Electric Company, Chicago, says that the enormous demand for their apparatus and supplies, far exceeding any anticipated increase, has compelled the company to commence the erection of two additional stories on their already large factory that has a frontage of 315 feet on South Clinton street. Early this year increased room was secured by the erection of two large wings, four stories in height, but it merely afforded temporary relief. Mr. Brown believes that great as this year's business has been, it will be far exceeded by that of 1890, and states that careful plans have been laid that will enable the company to handle properly and quickly whatever orders may come their way.

**Mr. John A. Hinsey,** the Milwaukee street railway king, is said to be contemplating the adoption of an improvement on the present system of hanging electric wires over the streets. A wrought-iron arch will span the street between every pair of poles to keep them from curving or breaking, and to prevent the wire from sagging. The cross wires will be supported by two properly insulated wires suspended from the arch. Guard wires will be hung from the arches parallel with and above the traction wires, so that if a telegraph or telephone wire happens to break it will not fall on the heavily charged wire. Mr. Hinsey's evident intention of preventing the possibility of an accident is worthy of much credit, irrespective of the success of the proposed plan.

**Rapid Transit for Municipalities.**—A Pittsburgh genius has devised a form of electric propulsion that will commend itself to many a weary night owl compelled to return home after the ordinary methods of transit have ceased from their daily task. According to the *Dispatch*, this invention, which is to revolutionize locomotion in cities, is a series of traveling sidewalks, composed of slats on an endless chain. Electric motors stationed at suitable distances will furnish the power to move these sidewalks at a rate of four miles an hour. As the average pedestrian possesses a three-mile gait, this will enable a man to travel easily at the rate of seven miles an hour. Only half the sidewalk will travel, that portion nearest the house line being stationary.

**Julius Andrae & Co.,** of Milwaukee, are carrying a very complete stock of electric light and power supplies, from Perkins' incandescent lamps down to copper brushes. They also manufacture a complete line of the tools required in circuit construction, such as climbers, digging bars, reels, etc., and are shipping same to the larger supply houses. In addition they have a completely equipped construction department for the installation of all classes of electrical apparatus, from a house bell to an incandescent dynamo. Henry P. Andrae, the junior member and secretary of the firm, is also the secretary of three social organizations, the Wisconsin Electric Club, the Calumet Club and the Milwaukee Wheelmen, in each of which his executive ability is highly appreciated.

**Rapid Transit in Detroit.**—The Detroit *Journal*, in speaking a good word for the electric railway, says: "Rapid transit is invariably the sign and evidence of the enterprise and progress of the place. In every city it has increased the value of property everywhere, made the suburbs valuable, increased the growth and population of the place. At a council meeting Charles Flowers, attorney for the Dix Avenue Electric Railway, the franchise of which is owned by the Detroit City Railway, explained that this road would be operated by the Sprague system, and that a double track would be asked for within the city limits. A. E. Peppers, representing the Electric Railroad Company, said that his road would be extended to Dearborn next spring, and that a down town connection would be a benefit to the city.

**Telephone Quotations.**—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone stocks as follows:

| | | | |
|---|---|---|---|
| Chicago | $308@$310 | Cumberland | $ 68@ $69 |
| Central Union | 58@ 59 | Wisconsin | 114@ 115 |
| Michigan | 95@ 98 | Bell of Missouri | 150@ 151 |
| Great Southern | 31@ 32 | Iowa Union | 23@ 25 |
| Colorado | 35@ 38 | Missouri and Kansas | 57@ 58 |
| Rocky Mountain Bell | 40@ 41 | | |

ELECTRIC LIGHT STOCKS.

| | | | |
|---|---|---|---|
| Chicago Arc Light and Power | $73@$76 | Chicago Edison Co | $105@$106 |

**Engineers' Club of St. Louis.**—The club met in the Elks club room Dec. 18. President Meier in the chair; 46 members and four visitors present. The executive committee announced the result of the ballot for officers for 1890 as follows: President, F. E. Nipher; vice president, George Burnet; secretary, Wm. H. Bryan; treasurer, Chas. W. Melcher; directors, E. D. Meier and S. Bent Russell; librarian and manager, J. B. Johnson; manager, J. A. Seddon. Col. Meier addressed the club at some length with a paper treating of the advances made during the year, particularly in the directions of civil, mechanical, mining and electrical engineering. Instances of remarkable work done in these branches were noted.

**In Memory of John Crerar.**—A memorial meeting in memory of John Crerar, late a director in the Chicago Telephone Company, filled Central Music Hall to overflowing with the leading citizens on Sunday afternoon. Eulogies on the grand character of the deceased were paid by the Hon. Thomas B. Bryan, Bishop Fallows, the Rev. Frank M. Bristol, and Mr. Franklin McVeagh. In concluding his remarks Mr. McVeagh spoke of John Crerar's loyalty to Chicago, and said he saw the city entering upon a career that would make it metropolitan in wealth and power, and appreciated its needs and responsibilities as the heart of the continent. He rose to the conception of the spiritual side of wealth; he rose to the conception of the spiritual side of progress. Let them believe that he did so knowingly, that his fame shall be certain and his name immortal.

**The Wisconsin Electric Club** is the latest and most important thing in the way of a social organization in Milwaukee, and is as its name indicates a club for the benefit of, and sole membership of, scientific gentlemen who are connected with electricity commercially, as a profession, or as a study. The objects are: To diffuse knowledge among those interested in electrical matters; to promote social intercourse, and to provide members with convenient club-rooms, where access to the latest electrical treatises and similar literature may be obtained. Frequent meetings of the club will be held for the reading of paper and general discussion, and occasional lectures will also be given upon interesting electrical subjects of the hour. The officers of the new club for the ensuing year are: President, A. J. Rogers; vice-presidents, J. A. McLeod, E. C. Wall and W. S. Johnson; secretary, H. P. Andrae; treasurer, W. H. Hyde; board of managers, F. E. Parker, S. G. Coleman, E. Richardson, R. H. Pierce, A. J. Shaw. The club now numbers 80 members, mostly men of prominence in connection with the telephone, electric lighting, electric street cars and similar commercial interests, but it proposes to extend itself, and applications for membership will be received by the secretary, Mr. H. P. Andrae, who will be glad to correspond with any of the fraternity regarding the contribution of papers to be read before the club.

**The Western Mining Department of the Sprague Company.**—The Western Mining Department of the Sprague Electric Railway and Motor Company has been established in handsome quarters in the Rialto building, Chicago, Ill., under the management of Mr. H. McL. Harding, who will make Chicago his headquarters and devote himself to developing this branch of the business. These offices are elegantly furnished in antique oak, to correspond with the woodwork of the large rooms they occupy. The offices are on the ground floor, occupying about one-quarter of the space of the building. Three clusters of incandescent lamps are suspended from the ceiling, besides various lights arranged in the private offices. Sprague motors and electrical mining machinery will be displayed in conspicuous places and shown in operation. Electrical devices of all kinds handled by the company may be found at this office. In addition to the space occupied for offices and salesrooms there are about 10,000 square feet in the basement devoted to store rooms. The Sprague Company have fifty offices in the United States, and hundreds of men employed day and night manufacturing electrical machinery. The West presents a large field for this line of work, and the Sprague Company, always abreast of the times, now offer to the public electrical machinery of all kinds for mining work, which for economy, reliability and efficiency cannot be excelled. The high reputation of this company is sufficient guarantee that all they claim for their machinery can be depended on. Full information and estimates for mining and irrigation work will be furnished from the Chicago office, and all those interested in mining and irrigation should call and see the great progress that has been made in these two branches of electric power transmission during the past year. F. De L.

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Cincinnati, O., Dec. 28, 1889.

**The Cincinnati Electric Light Company** will be ready to furnish current next week to any number of consumers.

**The Cincinnati, O., Electric Engine Company** are receiving many orders for their constant current motors, which are giving universal satisfaction.

**Mr. J. B. Lovell,** of Covington, Ky., has bought in at a forced sale the Geo. W. Card Manufacturing Company's plant at Cincinnati as an entirety, including patents, at an appraised value of about $7,300.

**Cincinnati Subways.**—The Cincinnati daily press are editorially advocating the construction of conduits for electric wires as a measure of public safety, but there is little hope that any decided action will be taken for two years, at least.

**Words of Wit and Wisdom from Wise.**—The arguments in the case of The Telephone Company against the Mt. Auburn Electric Railway for interfering with the telephone service by the introduction of the single trolley system, closed this week. Gov. Wise, of Virginia, representing the Sprague people, distinguished himself by making a splendid argument interspersed with flashes of wit and humor. The court house was crowded during the trial by the best people to hear the eloquence of this eminent attorney.

## ENGLISH NOTES.

(*From Our Own Correspondent.*)

London, Dec. 11, 1889.

**Electric Light v. Gas at Barnsley.**—The good people of Barnsley are at present engaged in an acrimonious dispute with the local gas company, which has announced its intention of raising the price of gas. The Corporation has applied for an electric lighting order, and the gas company has retorted by placarding the town with huge yellow posters headed "Electric Lighting and its Dangers," and, by making suitable extracts from Mr. Edison's recent article in the *North American Review*, have been able to serve up a very sensational dish. I am afraid that Mr. Edison in his eagerness to injure a rival has succeeded in doing considerable injury to electric lighting in general.

**Dockyard Central Stations.**—We are promised a development of central station lighting in a very unexpected direction. Money will be asked by the Admiralty next session to erect central lighting stations in our chief naval dockyards for the purpose of supplying current to ships preparing for sea. Hitherto the internal work on board new ships has been carried on very slowly owing to the state of semi-darkness in which the men have found themselves, and the same condition of affairs has been present even on board ships undergoing repairs, since the engines and boilers have usually been under repairs at the same time. It is now proposed to run the leads from the dockyard stations to the various buildings and repairing docks, and to connect the ships' wires in this way to a source of current.

**The Electric Lighting Boom.**—Each year by Nov. 20, all intending applicants for electric lighting provisional orders have to send in documents to the Board of Trade showing that they have complied with the various rules relating to the preliminary steps to be taken. A list of notices served upon local authorities, which was published in the *Electrician* in August, showed that close upon 500 provisional orders were then in prospect. The opposition and competition of local authorities, the lack of capital and other modifying influences have reduced the 500 provisional orders proposed in August to 179 on Nov. 30, and of these no less than 50 originate from local authorities, most of whom own gas works, and only apply for statutory powers as a *ruse de guerre*. Since considerably over 50 per cent. of the applicants have fallen out of the race in five months, it would be rash to prophesy how many will finally survive the Board of Trade inquiries and parliamentary committees. However, even on the supposition that only 50 per cent. of the 179 orders survive to the bitter end, and that many of these do not immediately become operative, enough will remain to keep our manufacturing firms very busy for some time to come.

**The Gas Strikes.**—We are still suffering acutely from "strike fever," and the employés at present most affected by it are the gas-stokers. Manchester has for several days been plunged into semi-darkness, due to an inadequate gas supply, caused by the strike of the stokers for more pay and less work, and a similar state of things will probably prevail in the course of a day or two all over London, south of the Thames. The inconvenience, not to say danger, of these frequently recurring gas strikes will, it can scarcely be doubted, give a decided impetus to electric lighting. The poorer

people will probably use oil more than ever, while those who can afford it will connect on to the nearest central station. It is, however, in street lighting that increased business may more especially be looked for, since several nights of dark streets will, it may be anticipated, induce rate payers to look more favorably on the "dazzling arc lamps."

**The Electrification of a Steam Jet.**—At the last meeting of the Physical Society Mr. Shelford Bidwell read a paper on "The Electrification of a Steam Jet," which he illustrated by some beautiful and striking experiments. Four ounces of water were introduced into a small laboratory boiler and the image of the steam jet issuing from a nozzle was thrown upon a screen. The jet was nearly transparent, neutral in color, and appeared to exert little absorbtion upon a beam of light which was transmitted through it. A bundle of points connected to one of the terminals of an influence machine was next brought close to the jet and the machine slowly worked. The image of the jet instantly became dark and dense and assumed a decided orange tint. When a ball was used instead of a point, a similar result ensued, but only when the ball was actually inside the jet. Mr. Bidwell said that he had examined the absorption spectrum of the steam jet, and had found that when unelectrified the jet had very little action on the spectrum. Electrification, however, was found to cause a total disappearance of the violet and a partial disappearance of the blue and green rays, the orange and red not being affected. Mr. Bidwell did not fail to point out how his experiments with the steam jet accounted for the characteristic blackness of thunder clouds and the lurid, yellow light which so often heralds thunderstorms. It was, however, very pertinently remarked by Prof. Sylvanus Thompson that there seemed to be a curious contrast between steam jets and clouds. Dr. Lodge's experiments showed that fog was *dissipated* by electrification, while Mr. Bidwell's experiments showed that a steam jet was concentrated, so to speak, by electrification.

## THE TELEGRAPH.

**Messages from Brazil.**—It is denied that cablegrams from Brazil are under censorship.

**Mexican Telegraphs.**—An English company recently made an offer for the government telegraph lines, which was refused. The same company now asks for the concession of a line to the Guatemalan frontier, with branches through the country east and west. It also proposes to establish lines throughout Central America.

**Mount Vernon, N. Y.,** is to have district messenger and burglar alarm service in connection with a telephone central office. The Board of Trustees has given a franchise to a company to go to work. The people think the burglar alarm branch is a particularly necessary one in view of the many burglaries that have recently occurred there.

**The Commercial Cable Company's** New York staff have issued a very pretty card of Christmas and New Year's greeting. It shows the two hemispheres joined by the Commercial cable, and bears also a fine vignette of the Statue of Liberty, with New York, Brooklyn and the bridge as the background. In one corner is a beautiful little drawing of the Cuttriss recorder We return the staff our compliments and heartiest good wishes.

**Suing the Western Union.**—In the United States Circuit Court, at Boston, on Dec. 28, Judge Colt heard arguments in the case of the Attorney General of Massachusetts against the Western Union Telegraph Company, which comprises three suits to recover taxes assessed upon the defendant for the years 1886, 1887 and 1888, amounting to $40,862. The tax was what is termed a franchise tax, and the defendant contends that it is liable to be taxed only on its tangible property in the State. Decision was reserved.

**The New York Quotation Company.**—There were filed in the office of the Secretary of State at Albany on Dec. 28, the certificate of incorporation of the New York Quotation Company, with a capital of $500,000. The company is formed for the building of telegraph lines throughout New York City and to cities and villages in and outside of this State from the several Exchanges in New York. The incorporators and stockholders are William H. Baker, Theodore L. Cuyler, Jr., of Brooklyn, and John O. Stevens, of Plainfield, N. J. Mr. Baker owns 4,980 of the 5,000 shares of stock, and Messrs. Cuyler and Stevens hold 10 shares each.

**Commercial Telegram Company.**—Mr. John W. Mackay has bought the Commercial Telegram Company from himself. He had been furnishing the money to keep it going for several years, and he finally concluded that he might just as well own the whole concern. So he procured a judgment for $300,000, which was executed last week. Col. Robert G. Ingersoll bid in the property for Mr. Mackay for $155,000. E. C. Platt, the agent of the Nevada Bank of San Francisco, was also a judgment creditor, and he joins Mr. Mackay in the purchase. It is probable that the business will continue as usual. The Commercial Telegram Company is the competitor of the Gold and Stock Telegraph Company in the delivery of quotations from the Stock Exchange by means of tickers, and operates chiefly under the patents of Stephen D. Field.

## THE TELEPHONE.

**The Government Telephone Suit.**—A dispatch from Harrisburg, Pa., states that testimony is being taken with regard to the Drawbaugh claims in the government telephone suit.

**"Dangerous to the State."**—Russian officials have decided that the telephone is "dangerous to the State." In Warsaw orders have been given that telephones be removed from all restaurants, coffee houses and liquor saloons. Similar orders have been issued in all other large Polish towns.

**Portable Telephones.**—There are some people who make queer disposals of their telephones. A well known undertaker of this city has his telephone on a dumb waiter. He runs it up to his room at night and can answer it without getting up. In the daytime he runs it up out of sight after he has used it, and when the people who are always wanting to "use your telephone for a moment" drop in for that purpose he tells them they can use it if they can find it.—*Detroit Free Press.*

## THE ELECTRIC LIGHT.

**Kingston, Ont.**—The gas and electric light companies have consolidated.

**The Bloomsburg, Pa., Electric Light Company** has been formed with a capital stock of $25,000.

**Burlington, Ia.**—The Burlington Electric Light and Power Company are going to put up a large station building, etc.

**Boonville, Mo.**—The Boonville Light and Power Company has been formed by J. Cosgrove and others, with a capital stock of $10,000.

**Belvidere, Ill.,** is about to establish an electric light plant within its precincts. The central station will be equipped with Westinghouse alternating current apparatus for a capacity of 750 lights.

**Gadsden, Ala.**—The Queen City Electric Light Company write us that they have the franchise and contract for lighting Attalla, Ala., for ten years. They will light the town from their plant at Gadsden, a distance of five miles.

**Alexandria, Va.**—Mr. C. S. Pardoe, the electrician, of Washington, reports making an official inspection of the Schuyler plant and circuits at Alexandria for the local city council, and finding them very satisfactory and thoroughly up to the contract.

**Americus, Ga.,** is said to be lighted by 40 arc lights costing $100 each and 135 gas jets at $18 each for one year. The cost of manufacturing the gas is said to be 60 cents per 1,000 feet, but it is furnished to the consumer at $2. Five miles of electric railway are now being built in Americus.

**Lynchburg, Va.**—An electric light company was organized a few days ago in Lynchburg, Va., and the Westinghouse Electric Company has been awarded the contract of equipping the power house with apparatus. An alternating current dynamo of 750 lights capacity is about ready to be shipped to Lynchburg in a day or so.

**Asbury Park, N. J.**—The Spring Lake and Sea Girt Company has purchased all the property of the Sea Girt and Spring Lake Beach Land and Improvement companies, including the lake at Spring Lake Beach and Wreck Pond. The company has a capital of $700,000. Electric light, sewer and water systems are to be completed in time for use next season.

**The East End Electric Light Company,** of Pittsburgh, Pa., which was supplied with the first dynamo of the new Westinghouse arc light system, expresses in a letter to the Westinghouse Electric Company the greatest satisfaction with the dynamo. That machine has a capacity of 60 arc lights, and it has been running without a flaw from the moment of starting.

**Oil Out of Favor in Guatemala.**—A report received at Washington from Guatemala states that since the introduction of electric lighting into the towns of that country there has been a large diminution in the importation of mineral oils. In the capital of the republic, with a population of 70,000, and in Quezaltenango, with 30,000, the consumption of oil has fallen off one-half. At San Jose, Retalhulen and Antigua, the substitution of electric lights for oil illumination has been in a still larger proportion.

**Jersey City, N. J.**—The Jersey City Aldermen gave the Bergen Electric Light, Power and Heat Company last week a franchise under which it can erect poles in all the principal streets of the city and run electric light wires on them. The vote on the franchise was eight to one, Alderman Jordan voting no. Another electric light ordinance was introduced which allows the Consumers' Gas Company to put up poles and run electric light wires on them. This was referred to the Committee on Streets of the Board.

**Electrically Illuminated Sights for Night Firing.**—The big guns turned out by the Elswick arsenal are now fitted with a device to facilitate firing at night. The ordinary sights are illuminated by a small incandescent lamp, the rays from which, passing through a lens, are converged, so that only a minute point or line of light just sufficient to distinguish the sight is obtained. By means of an adjustable resistance, the light can be modulated to suit the degree of darkness of the night or the eye of the observer.

**Jamestown, N. Y.**—On Dec. 26, at a special election, Jamestown voted by thirty-nine majority to bond itself in the sum of $25,000 for an electric light plant. At a special election six weeks ago the same proposition was defeated by nearly a hundred majority. The local electric light company offered street lights at $72 per year each, and it is probable that the matter will be fought out in the courts, as the company and many citizens believe the second special election is illegal. The city now has no debt, and needs sewers and paving.

**Electricity and Veterinary Surgery.**—Two members of the Vienna Military Veterinary Institute have introduced an improvement in the use of the laryngeal mirror for horses. The ordinary mirror, which at its outer end has an incandescent electric light, is introduced into the nostril, and at once makes visible any symptoms of nasal mucus and other diseases which call for the prompt isolation of the animal. The operation has proved possible even in the case of obstinate horses, and a quiet animal will submit to it without resistance.

**Rockland, Me.**—The contract for street lighting for a term of five years, awarded the Easton Electric Company of New York, has been transferred to the Eastern Electric Construction Company of Portland, who have purchased the gas company and electric company and will unite both companies under one management. They will build suitable buildings on vacant land of the gas company for an arc, incandescent and electric power station, and extend the system to Thomaston. F. A. Sawyer, treasurer of the Construction Company, will be treasurer and manager.

**Portland, Ore.**—The Westinghouse Electric Company has closed a contract with the Willamette Falls Electric Company, of Portland, Ore., the specifications of which contain some unique features. The Portland corporation intend to light up the streets and houses of that city and they are going to establish a central station plant and equip the same with Westinghouse alternating current machinery for a capacity of 6,000 incandescent and 100 arc lamps. The central station it is proposed to erect at Willamette Falls, a distance of 12 miles from Portland, because the company wants to utilize water power in the generation of the electric current. From the station the current is to be carried to a branch station in the city and thence it is to be distributed. Owing to the long distance, the current is to be carried previous to its distribution, the Westinghouse company will make special apparatus for this plant capable of generating a current of 4,000 volts. The arc light machine chosen by the Portland company is of the new system of the Westinghouse company, and the entire number of lights is to be run from one machine.

## APPLICATIONS OF POWER.

**Blacksburg, S. C.**—The Blacksburg Street Railway and Electric Light Company has been formed by J. F. Jones, W. W. Hardin, F. P. Beard and others.

**Schenectady, N. Y.**—The Albany Railroad Company, of Schenectady, is increasing its capital stock from $275,000 to $750,000, and will, it is said, adopt electricity.

**Syracuse, N. Y.**—It is announced that F. C. Eddy, of the Bank of Syracuse, and Theodore L. Poole have been busy in the interests of a syndicate composed of New York and Boston capitalists, and that they have secured an option on several street railways of Syracuse. It is designed to use electricity as a motive power, and it is said that the transfer of the properties in question will be made on Jan. 1.

**The Jeffrey Electric Coal Mining Machines** are now in successful operation at Shawnee, O.; Jobs, O.; Thurmond, W. Va., and Cannelton, Pa., while other plants are in course of construction at Fairmont and Parkersburg, W. Va. It is claimed that these machines are the only ones in regular daily operation. They are manufactured by the Jeffrey Manufacturing Company, of Columbus, O., whose electric haulage system is also a great success, and is in operation at Pawnee and Thurmond. The company issue a neat folder circular as to their apparatus for coal cutting, and call attention therein to its many good points.

## PERSONALS.

**Mr. T. A. Edison** went before the New York Grand Jury last week to give his views on the overhead wire question.

**Mr. A. H. Kroedel,** formerly superintendent of the Walla Walla Electric Light and Power Company, will take charge of the plant at Hailey, Idaho.

**Mr. A. E. Kennelly** has an excellent article, well illustrated, in the January *Scribner's Magazine* on "Electricity in the Household." It is one of the "Electric Series."

**Mr. C. W. Pierce,** the superintendent of the Brush Electric Light Company, of this city, has been indicted for manslaughter, in connection with one of the deaths caused by accident recently.

**Prof. Elihu Thomson** has now informed Secretary Garratt of the title of his paper for the February meeting at Kansas City of the National Electric Light Association. It is "Safety Devices in Electrical Installations."

**Mr. G. W. Mansfield,** the well-known electric railway engineer, gave an interesting lecture last week in Boston, in the course at the Wells Memorial Hall on the electric railway, illustrating his remarks with chalk diagrams.

**Prof. Charles R. Cross,** of the Massachusetts Institute of Technology, will lecture before the New York Electric Club on Thursday evening, Jan. 16. Subject: "Some Acoustic Principles of the Telephone." The lecture will be illustrated by experimental apparatus.

**Mr. A. A. Knudson,** the electrical engineer who had charge of the St. John, N. B., Electrical Exhibition, has proposed for the New York World's Fair a sort of modern and American edition of the hanging gardens of Babylon, with a horseshoe-shaped waterfall 160 feet high, the height of Niagara pouring from one of its sides. The structure is to be of Moorish design and built chiefly of iron. The proposed height is 272 feet, the width decreasing from 100 feet at the base to 80 at the top. The building is divided into five stories. The whole he proposes to light by electricity.

**Mr. Geo. H. Benjamin,** in a letter to the New York *Sun* says: "Mr. Edison makes a point of the fact that low tension currents are not dangerous to life. He omits to mention, however, that there is a vastly greater danger from fire from low tension currents than where a high tension current is employed. It is true that there are a considerable number of deaths chargeable to high tension currents, but I believe it to be equally true that the fire loss chargeable to low tension currents in the past five years exceeds, by forty (40) per cent., the dividends paid by the companies employing the low-tension current. In other words, that the insurance companies of the United States would have been forty (40) per cent. better off had they paid the dividends of the low tension electric lighting companies under a contract with these companies that they should not do any business. Public safety implies safety to life and property, and I think I am safe in saying that every disinterested electrician of the world will agree that high-tension currents may be so located and arranged that they will be absolutely harmless both to life and property."

## MISCELLANEOUS NOTES.

**A German Electrical Exhibition.**—Frankfort, in Germany, is making preparations for an electro-technical exhibition, to be held from May to October, this year. Dr. Siemens, Mr. Edison and Sir William Thomson have been made honorary members of the committee.

**Utilizing Niagara.**—M. Maginn, of Chicago, has been awarded a gold medal by the Buffalo International Fair for his device for utilizing Niagara. It is a water wheel traveling on a frame and catching the inside flow of the Fall, so as to be out of sight. There were 150 competitors.

**Double-Petticoat Insulators.**—A bill in equity was filed at Boston, Dec. 18, in the United States Circuit Court, by the American Insulator Company for injunction to restrain the Electrical Glass Corporation from making double-petticoat insulators, as being an infringement of patents held by the plaintiff.

**Kemmler to be Electrically Executed.**—At the moment we go to press, Judge Dwight, of the General Term, in this State, has handed down a decision to the effect that the punishment of electrical execution is unusual, but not necessarily cruel, and that it therefore is not unconstitutional. The order dismissing the writ of habeas corpus has been confirmed, and Kemmler has been handed to the custody of the agent of the State charged to carry out the sentence.

**Sharp & Kent,** Connaught Mansions, Westminster, England, have sent us a copy of their new price list for all kinds of electrical measuring instruments. They say: "We have abolished all extra charges, and each ammeter and voltmeter is now sent out with a silver dial and an enameled scale, and the voltmeters are supplied with keys. The marine type is being largely used for omnibuses, tramcars and steamships, etc., and is suitable where any movement of the vehicle may affect the needle." The instruments in question are to be well made and decidedly cheap.

**Utilizing Water Power.**—The Baltimore *Manufacturers Record* says: "The magnificent water powers running to waste in the South can be used to advantage for generating electricity for illuminating and manufacturing at long distances from the streams. Suppose the power running to waste in the French Broad at Asheville, N. C., were caught up from the current and wired to that beautiful city, it would be sufficient to illuminate streets and buildings and to run all the machinery in her factories. Many other Southern towns through which railroads run are within transmission distance of streams of sufficient volume and current for electrical purposes."

**"The Boy Spy"** is the title of an illustrated volume of 556 pages, just issued, chronicling the thrilling experiences, captures and escapes of the author, Major J. O. Kerbey, a spy on the Federal side during the Civil War. The genial major, now a newspaper

man at the national capital, was a telegraph operator both before and during the war, and also for many years afterward. Much of his book relates to the part played by telegraphy in the war. In fact, the sub-title of "The Boy Spy" says it is "the only practical history of war telegraphs in the field—a full account of the mysteries of signaling by flags, torches and rockets." The book is well printed on good paper, and is substantially bound in cloth. The price, including postage, is $2, and copies can be had by addressing Major J. O. Kerbey, P. O. box 293, Washington, D. C.

## BUSINESS NOTICES.

**Battery Cut-Out.**—Attention is called to a simple device for disconnecting gas-lighting batteries if accidently grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

**Houston's Electrical Dictionary.**—The New York *Herald* says of Prof. E. J. Houston's "Dictionary of Electrical Words, Terms and Phrases:" "A book of this kind is absolutely necessary to the general reader who wishes to understand any modern article on applied electricity, and Mr. Houston's book seems to answer the purpose. It contains more than six hundred pages, and the definitions are often more suggestive of cyclopædia than dictionary, which is a virtue instead of a fault. The pages abound in illustrations."

**Abendroth & Root Boilers.**—The new catalogue recently issued by Messrs. Abendroth & Root Manufacturing Company, 28 Cliff street, New York, reflects much credit on all interested in its make-up. The book consists of nearly 50 pages of well-written text, generously illuminated by finely drawn engravings, and treats at length of the construction and advantages of the new Root water tube safety boiler made by the company. This is supplemented by 23 pages of tabulated data of interest and value to engineers and steam users generally. As a frontispiece is shown a finely executed lithographic view of the extensive works of the Abendroth & Root Manufacturing Company, located at Greenpoint, Brooklyn, N. Y. The special department, devoted exclusively to the manufacture of the Root water tube boiler, comprises the pattern shop, foundry—with daily capacity of 10 tons—boiler shop, machine shop, erecting shop and testing room. These with the plate iron shop, sheet iron shop, blacksmith shop, store house, shipping department, brass shop, and general offices, are all shown in the view mentioned. The covers are very tastefully gotten up and printed in three colors, the designs being original and attractive. That on the front cover bears the title "Steam Boilers," seen in a cloud of steam issuing from the safety valves of a Root boiler, a partly exterior and interior view of the upper half of which is shown below. This is surrounded by a frame or border of unique design setting forth the most prominent characteristics of the boiler. The design on the back cover consists of this same frame surrounding an interior view of a large boiler tube, in the far end of which is shown an excellent vertical sectional view of the Root water tube boiler.

# OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

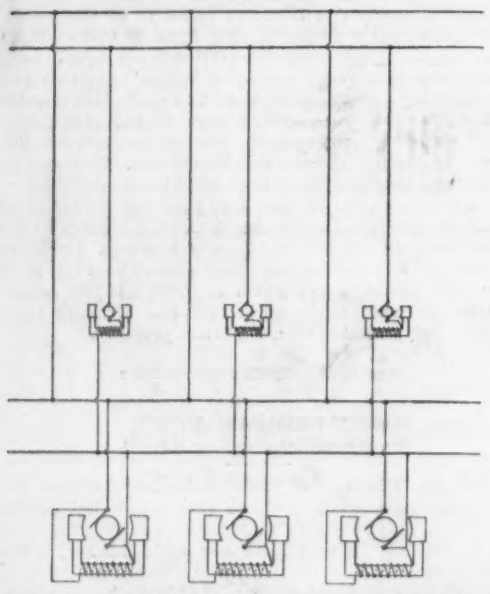
## PATENTS ISSUED DEC. 17, 1889.

**417,217. Electrical Apparatus;** Chauncey D. Baker and Lewie G. Bronson, of Chicago, Ill. Application filed April 30, 1888. Renewed Aug. 8, 1889. An armature composed of two parts hinged or joined together, the entire armature being also hinged or joined together, as usual, whereby either end of the armature can be brought into connection with contact points.

**417,258. Railway Signal;** Irvin W. Loy and Richard O'Toole, of Mechanicstown, Assignors of one-third to John F. Matthews, of Baltimore, Md. Application filed June 29, 1889. In an apparatus for giving an automatic signal of an approach of a railroad train the combination of a track bar mounted upon rocking supports, a circuit closing device connected to and operated by the motion of the track bar, springs operating upon the track bar, so as to maintain it at its highest elevation, and an electric circuit, including the circuit closing device, and an electro magnet, the armature of which is secured to a rock shaft, to which is also secured a detent hook which engages a notch in a detent wheel, which is a member of a train operated by the vibreting armature of a magneto-electric bell, the circuit of which is closed when the armature of the electro-magnet in the main line is attracted and the detent hook raised, releasing the train, which is broken by the armature of the main line magnet when the detent hook falls back into its notch.

**417,259. Electrically Propelled Vehicle;** William Main, of Brooklyn, N. Y. Application filed May 23, 1889. The combination of the car having a space for batteries, a removable panel closing the space through which the batteries are introduced, and a number of separate battery cells connected to the panel and removable with it.

**417,271. Telephone Exchange Apparatus;** Joseph John O'Connell, of Chicago, Ill. Application filed Jan. 2, 1889. A telephone line extending from a subscriber's station to the central office, and a switch for closing the line at the subscriber's station to ground, to include the subscriber's telephone line therein, the telephone line being provided with two branches connected to different portions of a converter, in combination with a telephone



No. 417,668.—METHOD OF REGULATING THE TENSION OF THE ELECTRIC CURRENT.

connected to another portion of the converter whereby when the line is grounded at the subscriber's station the subscriber may talk to the listening operator, while on disconnecting the line from ground, any currents over the line will be neutralized at the converter, being sent in opposite directions through different portions of the same.

**417,290. Galvanic Battery;** Elmer A. Sperry, of Chicago, Ill., Assignor to the Electrical Supply Company, of Ansonia, Conn. Application filed April 1, 1889. In a galvanic battery, the combination of a central plate having arc-shaped scallops about its edge, with a series of elements, each one of the scallops secured at one end to the plate, the remaining portion of such elements being free.

**417,304. Electric Circuit;** John Cornelius Wilson, of Boston, Mass. Application filed July 23, 1889. Two metallic circuits or loops arranged adjacent to each other, combined with telephonic instruments and a condenser included in multiple arc between the two circuits.

**417,305. Electric Circuit;** John Cornelius Wilson, of Boston, Mass. Application filed July 23, 1889. A metallic circuit comprising two loops starting and terminating at the same station, the loops running adjacent to each other, combined with condensers and telephonic instruments arranged in multiple arc between the loops.

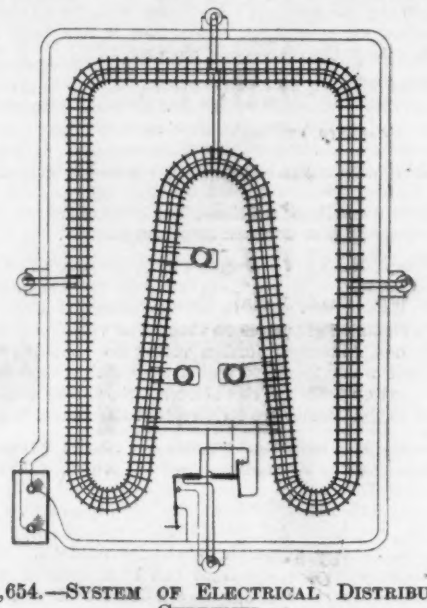
**417,338. Method of Operating Electric Railways;** Elias E. Ries, of Baltimore, Md., Assignor by direct and mesne assignments to Ries & Henderson, of same place. Application filed June 22, 1888. In an electric railway, the combination of line conductors, a suitable generator for supplying current to the conductors, a traveling electric motor, an auxiliary generator and an automatic switch controlled to correspond with the inclination of roadbed to connect and disconnect the auxiliary generator with the motor.

**417,392. Treatment of Porous Pots for Electric Batteries;** Erhard Ludwig Mayer and Henry Liepmann, of London, County of Middlesex, England. Application filed April 17, 1889. Patented in England July 20, 1887. The method of increasing the resistance of a porous pot, plate, or partition for electric batteries without destroying the porosity of the pot, plate, or partition, which consists in depositing within, or upon the same, a substance unattackable by the constituents of the battery.

**417,402. Electrical Conductor;** Upton H. Balsley, of Philadelphia, Pa. Application filed June 8, 1889. A multiple conductor consisting of a series of warps, each formed of a pair of insulated wires arranged side by side in mechanical contact with each other and bound together with a flat web by weft threads interlacing with the warps without passing between and separating the wires of each pair forming the warps.

**417,407. Electric Stenographic Pen;** Augustus S. Cooper, of Santa Barbara, Cal. Application filed Jan. 2, 1889. The invention consists in the combination, with a pen formed of a series of conducting points, of an electric generator, a circuit, a series of keys to be operated by the hands and feet, a conducting plate for receiving the paper on which the record is made, and a series of thumb screws so that the conducting wires will be made interchangeable. See illustration.

**417,436. Manufacture of Porous Pots for Electric Batteries;** Erhard L. Mayer and Henry Liepmann, of London, County of Middlesex, Eng. Application filed Oct 8, 1889. Patented in England July 20, 1887, and in Belgium June 29, 1889. In

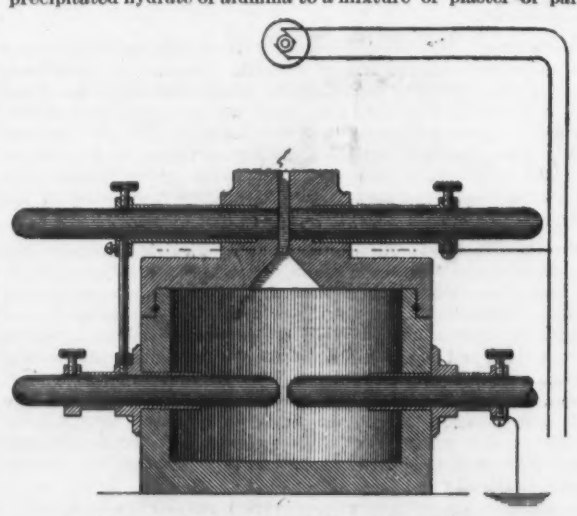


No. 417,654.—SYSTEM OF ELECTRICAL DISTRIBUTION OF CURRENTS.

the manufacture or treatment of porous pots, plates or partitions of inorganic mineral material for electric batteries, consisting in the impregnation of the same with a substance containing the body or elements to be deposited and afterward decomposing the substance by the action of heat, so as to bring about the necessary decomposition of the substance for the purpose of precipitating or depositing the body in the pores and interstices of the porous pots, plates or partitions. See illustration.

**417,438. Train-Signal;** Daniel S. McElroy, of New York, N. Y. Application filed May 16, 1889. The invention consists in the combination, with the cars, of electric conductors and keys, whereby the circuit extending through the train may be opened, and in the combination, with the circuit wires, with ground wires running to the axle boxes and provided with a switch, whereby the train circuit may be grounded in any car.

**417,458. Galvanic Dry Element;** Carl Heinrich Wolff, of Blankenese, Prussia, Germany, Assignor to F. Weber & Co., of Philadelphia, Pa. Application filed Sept. 7, 1889. Patented in Germany Sept. 11, 1888. The invention consists of the addition of precipitated hydrate of alumina to a mixture of plaster of paris



No. 417,694.—LIGHTNING ARRESTER.

with other liquid absorbing inactive material and generating salts or their solutions employed as a filling matter for galvanic dry elements.

**417,474. Electric Fan;** Philip Diehl, of Elizabeth, N. J. Application filed Aug. 15, 1889. In an electric motor, the combination with the field magnet, armature and brushes of a commutator consisting of a series of flat, irregular, or notched and projecting sections internotched together.

**417,487. Automatic Regulator for Dynamos;** Charles D. Jenney, of Indianapolis, Ind., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed June 11, 1888. The invention consists in the arrangement of continually revolving wheels in such relation to properly connected electromagnets that when the magnets are energized the wheels will be operated as armatures, and thus drawn into engagement with a suitably constructed clutch by which other mechanism is operated, and a greater or less proportion of the resistance in a properly connected rheostat thus cut into or out of the circuit.

**417,497. Combined Support and Safety Device for Overhead Conductors;** Robert A. Morgan, Jr., of Boston, Mass. Application filed Aug. 27, 1889. The invention consists in the combination, with an overhead conductor forming part of a ground circuit and made of independent sections, of a safety device or cut-out interposed between adjacent sections, whereby the current is cut off from the ground through a broken section.

**417,511. Multiple Telephone;** A. M. & J. R. Rosebrugh, of Toronto, Ont., Can. Application filed Nov. 27, 1886. For description see this issue, page 2.

**417,516. Arc Lamp;** Jabez F. Shawhan, of Dayton, O., assignor of one half to James W. Carpenter, of same place. Application filed March 23, 1888. The combination, with a casing inclosing the operative parts of the mechanism, of a fixed electrode, a carrier supporting a movable electrode, guide rods mounted upon the casing and passing through the carrier, a constantly operated motor inclosed in the casing, a vibrating bar carrying a pawl for driving the screw, and electromagnets also inclosed in the casing for controlling the operation of the pawl.

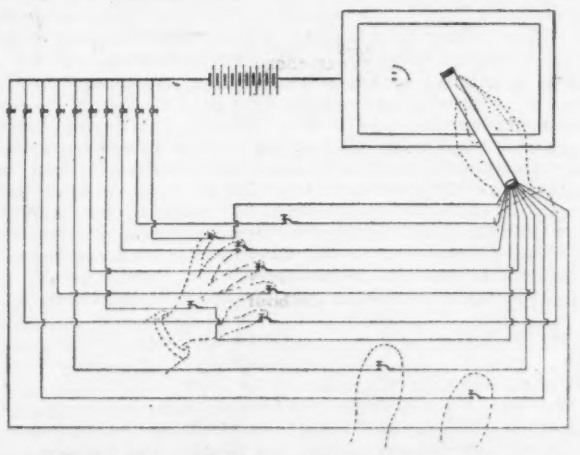
**417,654. System of Electrical Distribution of Currents;** Charles Van Depoele, of Lynn, Mass. Application filed Sept. 21, 1889. A system of supplying and distributing currents for electric railways, comprising normally continuous working conductors along the line of way, a source of continuous current of relatively high potential, a supply circuit extending from the source to points adjacent to the working conductors, and a plurality of transformers adapted to be operated by the continuous current supply and to deliver alternating or discontinuous currents to the working conductors.

**417,660. Telephonic Instrument;** William Chase Barney, of Baltimore, Md. Application filed April 13, 1889. In an instrument for transmitting electrical impulses by sound, a diaphragm or tympan of thin sheets made of asbestos coated on one or both sides with collodion.

**417,668. Method of Regulating the Tension of the Electric Current;** Carl Dihlman, of Berlin, Germany. Assignor to Siemens & Halske, of same place. Application filed April 5, 1889. The invention consists in causing the current to be regulated to pass through a constantly driven armature of a dynamo-electric machine, the strength of the magnetic field of which is dependent upon the strength of the main current to be regulated, whereby any change in the electromotive force of the current causes a corresponding change in the strength of the magnetic field of the dynamo-electric machine and a change in the tension of the current generated by the armature thereof, which, added to the tension of the current to be regulated, restores the latter to its normal electromotive force.

**417,685. Ceiling Plate for Electric Lights;** Harry H. Sawyer, of Ridley Park, Assignor of one-half to the Thackara Manufacturing Company, of Philadelphia, Pa. Application filed July 3, 1889. The invention consists in a plate having openings for electric wires and an opening for an insulating disc, the latter being provided with a shoulder upon which a plate rests and sustained by a pipe which is in contact with the disc.

**417,688. Conduit for Electrical Conductors;** James Tatham, of Philadelphia, Pa., Assignor of one-half to Henry B. Tat-



No. 417,407.—ELECTRIC STENOGRAPHIC PEN.

ham, of same place. Application filed Sept. 23, 1889. The invention consists of an outer pipe or casing, an internal lining tubing and a layer of insulating material, confined or compressed between the outer pipe or casing and the lining tube. The outer pipe or casing is preferably of cylindrical form and of iron or steel, an ordinary wrought-iron pipe being available for the purpose. The interposed insulating layer is preferably a tubular web, of textile material, coated or saturated with the insulating material or compound, and the lining is in the form of a seamless tube of metal.

**417,694. Lightning Arrester;** Paul Winsor and Alexander Wurts, of Pittsburgh, Pa., Assignors to the Westinghouse Electric Company, of same place. Application filed Sept. 25, 1889. The invention consists in one or more pairs of discharge points or plates placed in such relation to each other and to the circuit to be protected that the lightning discharge will pass across the intervening space to the earth and cause such an expansion of the air, gas or fluid within an inclosing chamber as to directly or indirectly interrupt the flow of current through the circuit.

**417,695. Lightning Arrester;** Paul Winsor, of Pittsburgh, Pa., Assignor to the Westinghouse Electric Company, of same place. Application filed Nov. 4, 1889. The invention consists in causing the heat generated at the arc by the flow of current to effect such an expansion of the surrounding air, gas or other medium as to automatically extinguish the arc. This is accomplished by inclosing the discharge plates within or at the mouth of a closed chamber and causing the expanded air, gas or fluid within the chamber to escape between the discharge plates or electrodes.

## PATENTS EXPIRED DEC. 17, 1889.

**11,047. Secondary Battery;** Joseph Wilson Swan, of Lauriston, Bromley, County of Kent, England, Assignor by mesne assignments to the Electrical Accumulator Company, of New York. Application filed Oct. 16, 1889. Patented in England, May 24, 1881. A perforated or cellular plate for secondary batteries, having the perforations or cells extending through the plate and the active material or material to become active packed in the perforations or cells only.

*Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times Building, N. Y.*